Πνευμονική εμβολή

Ευφροσύνη Δήμα

Πνευμονολόγος – Εντατικολόγος

Α΄ Κλινική Εντατικής Θεραπείας

Νοσοκομείο Ευαγγελισμός

ESC
European Society of Cardiology
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ESC GUIDELINES

2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS)

The Task Force for the diagnosis and management of acute pulmonary embolism of the European Society of Cardiology (ESC)

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Conflict of interest

‘I have no conflict of interest to declare’

Περιστατικό

- Ασθενής 59 ετών προσέρχεται στα ΤΕΠ μετά από παραπομπή του καρδιολόγου της, τον οποίο επισκέφτηκε λόγω αισθήματος παλμού και δύσπνοιας.

  Προ 10 ημέρου η ασθενής αναφέρει δύσπνοια, χωρίς πυρετό ή άλλη συνοδό συμπτωματολογία.

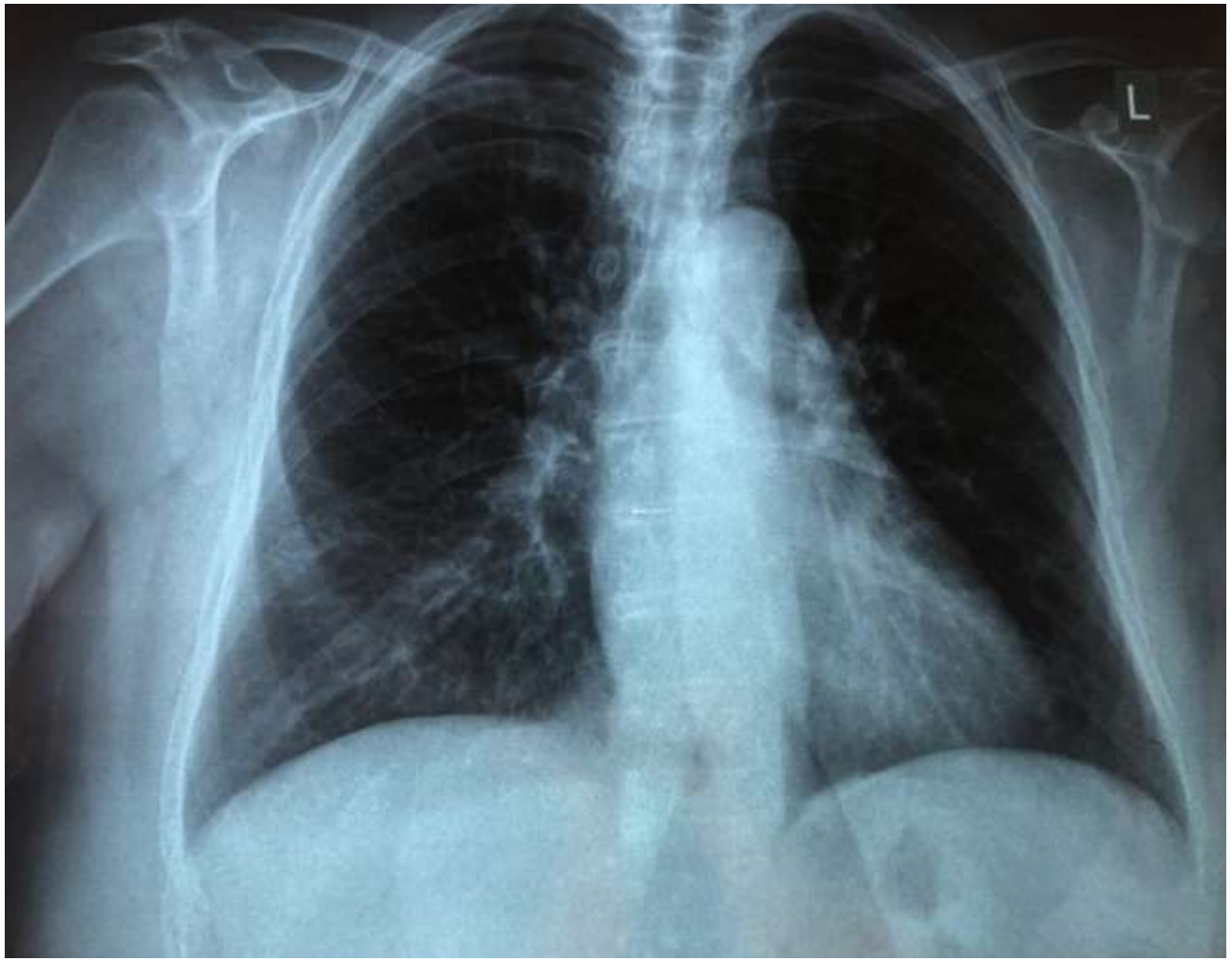
  Διαπιστώθηκε ΚΜ, η οποία ανατάχθηκε φαρμακευτικά και συνεστήθη στη συνέχεια στην ασθενή να επισκεφτεί πνευμονολογικό ΤΕΠ.

  Α/Α: ΑΥ, πρώην καπνίστρια

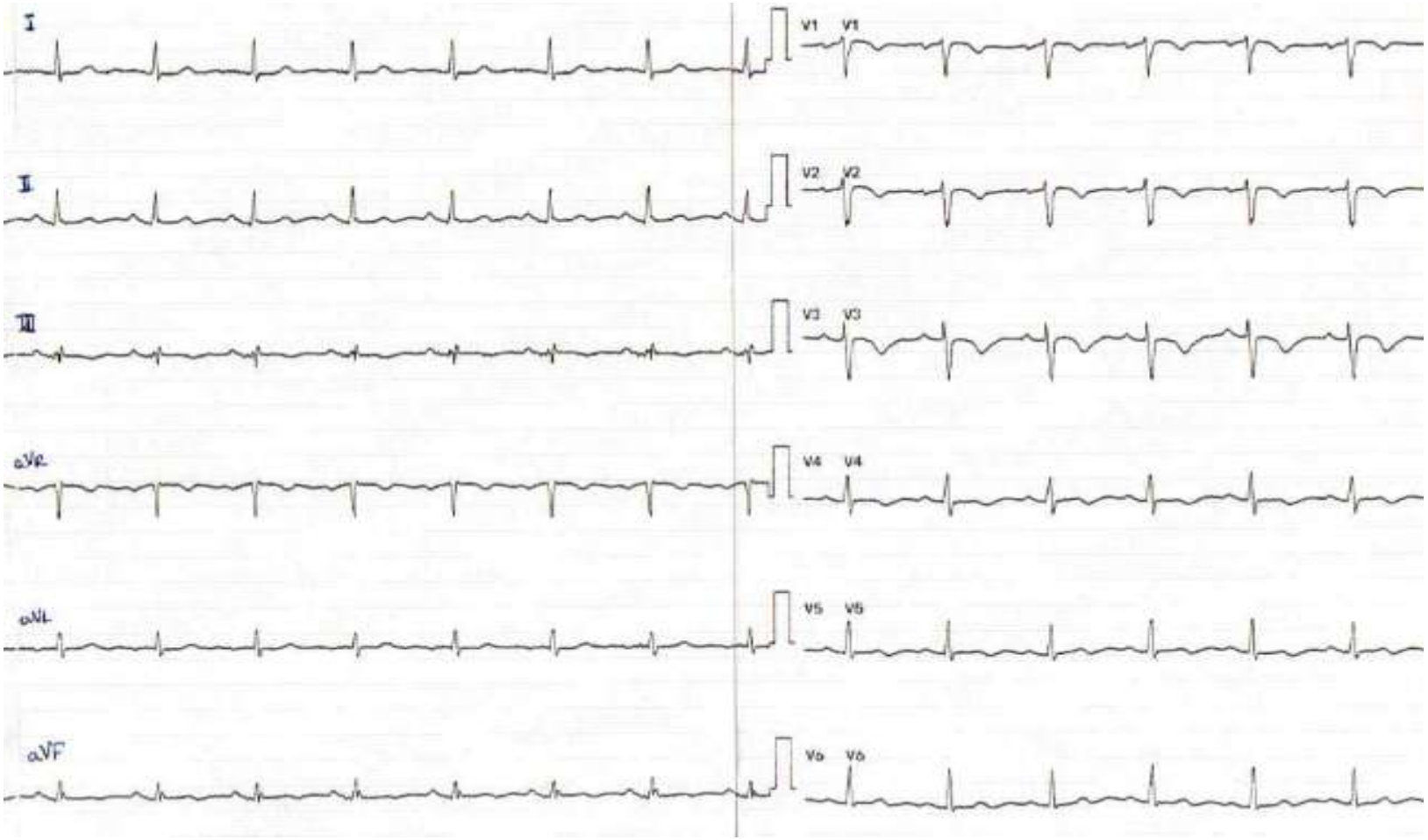
Από την κλινική εξέταση

- RR 16/min, Sat 97% (FiO_2 21%), φυσιολογικό αψ
- HR 78/min, ΑΠ 160/80mmHg
- Χωρίς άλλη σημειολογία από την αδρή κλινική εξέταση

Ακτινογραφία



НКГ



Εργαστηριακός έλεγχος

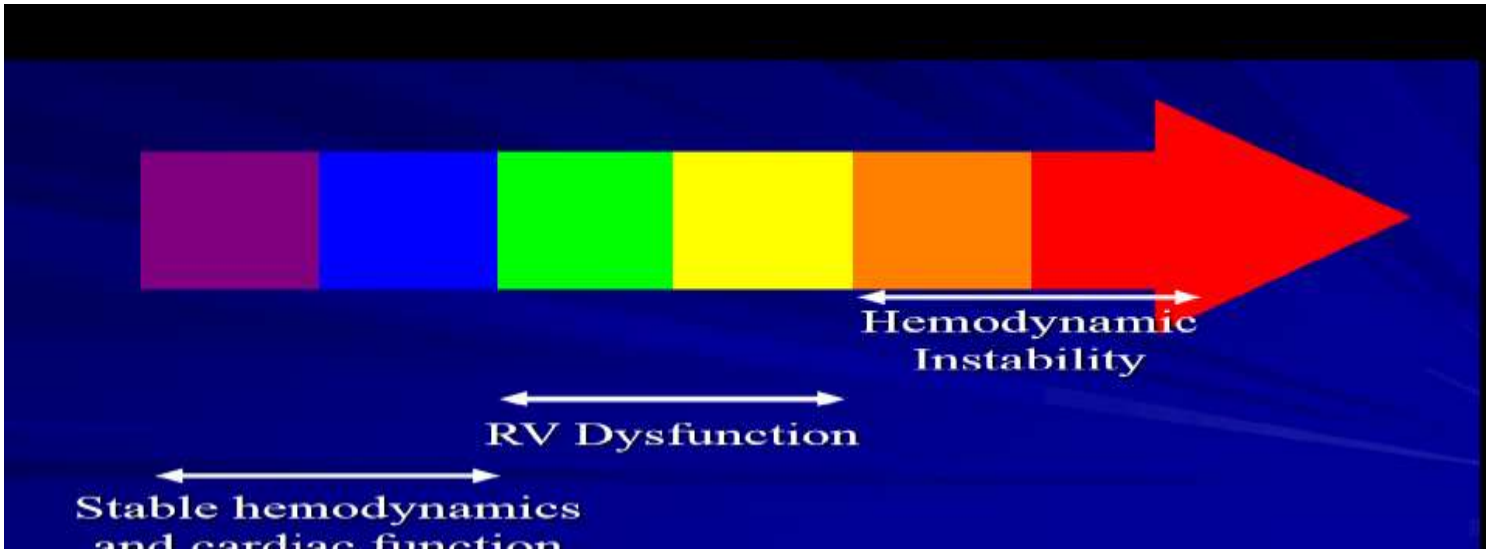
ΓΕΝΙΚΗ ΕΞΕΤΑΣΗ ΑΙΜΑΤΟΣ		ΤΙΜΕΣ ΑΝΑΦΟΡΑΣ * Validator SIS (Results)
Λευκά Αιμοσφαίρια και Τύπος		
Λευκά αιμοσφαίρια WBC	6.81	4 - 10.5
Ουδετερόφιλα NEU%	**77.9**	40 - 70
Λεμφοκύτταρα LYM%	**16.6**	25 - 45
Μονοκύτταρα MONO%	5.3	2 - 10
Βασεόφιλα BASO%	**0.1**	0.3 - 1
Ηωσινόφιλα EOS%	**0.1**	1 - 6
NEU#	5.30	2 - 7.7
LYM#	**1.13**	1.5 - 4
MONO#	0.36	0.02 - 1
BASO#	**0.01**	0.01 - 0.1
EOS#	**0.01**	0.04 - 0.4
Ερυθρά και ερυθροκυτταρική σειρά		
Ερυθρά αιμοσφαίρια (RBC)	**5.71**	4.1 - 5.1
Αιματοκρίτης (HCT)	38.1	37 - 47
Αιμοσφαιρίνη (HGB)	12.9	12 - 15
MCV	**66.7**	80 - 98
MCH	**22.6**	27 - 33
MCHC	33.9	32 - 36
RDW-SD	**47.6**	38 - 43
RDW-CV	**20.8**	11 - 16
Αιμοπετάλια		
Αιμοπετάλια (PLT)	257	140 - 450
PDW	----	9 - 17
MPV	----	6 - 11
P-LCR	----	13 - 43
PCT	----	0.17 - 0.35
Λοιπά στοιχεία		
Εμπύρηνα ερυθρά (NRBC%)	0.0	/100WBC
ΕΛΕΓΧΟΣ ΑΙΜΟΣΤΑΣΗΣ		* Validator STAR
Χρόνος Quick PT	14.3	sec
Χρόνος Quick (PT%)	**69**	80 - 110 %
INR	1.17	
APTT	32.1	26 - 38 sec

ΒΙΟΧΗΜΙΚΟΣ ΕΛΕΓΧΟΣ		ΤΙΜΕΣ ΑΝΑΦΟΡΑΣ * Validator clTm (Results)	
Γλυκόζη ορού	87	70 - 110	mg/dL
Ουρία ορού	18	10 - 50	mg/dL
Κρεατινίνη ορού	0.8	0.6 - 1.4	mg/dL
Νάτριο ορού	136	135 - 147	mmol/L
Κάλιο ορού	3.5	3.5 - 5.1	mmol/L
Ολικά λευκώματα ορού	6.6	6 - 8.2	g/dL
LDH ορού	200	< 225	IU/L
Κρεατινική Κινάση(CK) ορού	152	10 - 173	IU/L 37°C
Κρεατινική Κινάση(CKMB) ορού	16	1 - 18	IU/L
CRP ορού	0.2	< 0.5	mg/dL
Troponin-T high sensitive ορού	8	< 12	pg/mL Φυσιολογικό
		12 - 52	pg/mL Επανάληψη μετά 3ωρο
		> 52	pg/mL Παθολογικό

Ερώτηση 1

- Τι θα κάνετε έπειτα;

1. Δε θα διερευνήσω άλλο στα ΤΕΠ τη διάγνωση, θα την παραπέμψω στο ΤΕΙ
2. Θα την παραπέμψω στους καρδιολόγους – το πρόβλημά της είναι αμιγώς καρδιολογικό;
3. Θα στείλω d-dimers και ανάλογα με το αποτέλεσμα θα συνεχίσω ή όχι τη διερεύνηση;
4. Θα ζητήσω CTPA;
5. Θα ζητήσω CTPA και θα χορηγήσω αντιπηκτική αγωγή;



-Dyspnea at rest or with exertion (73%)
- Pleuritic pain (66%)
- Cough (37%)
- Orthopnea (28%)
- Calf or thigh pain and/or swelling (44%)
- Wheezing (21%)
- Hemoptysis (13%)

- Presyncope,
- Syncope, and
- Hemodynamic collapse (<10 percent)

PIOPED II. Am J Med 2007

Signs

- Common presenting signs on examination include :
  - Tachypnea (54 %)
  - Calf or thigh swelling, erythema, edema, tenderness, palpable cords (47%)
  - Tachycardia (24 %)
  - Rales (18 %)
  - Decreased breath sounds (17%)
  - An accentuated pulmonic component of the second heart sound (15 %)
  - Jugular venous distension (14%)
  - Fever, mimicking pneumonia (3%)

PIOPED II. Am J Med 2007; 120:871

Laboratory tests

Laboratory tests are not diagnostic

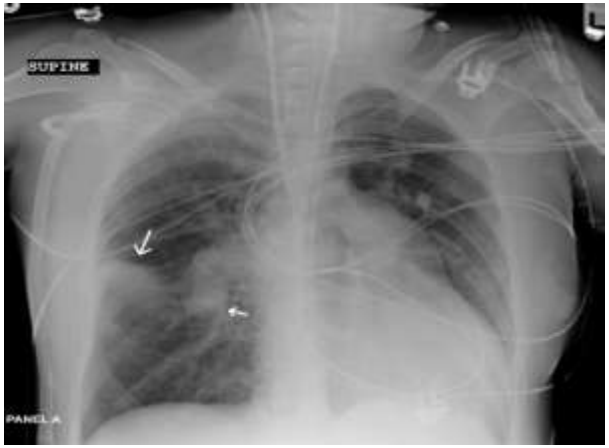
- **Complete blood count and serum chemistries** – leukocytosis, ESR, LDH and AST

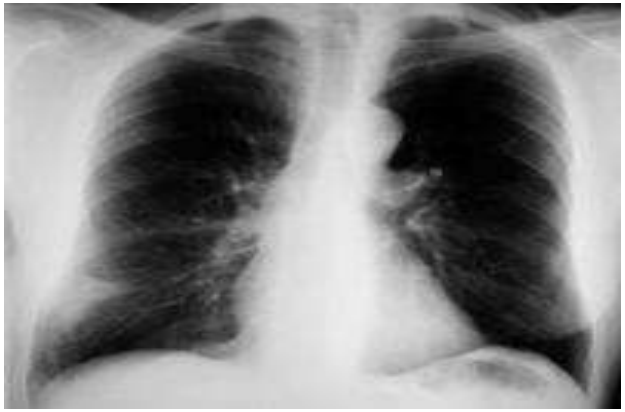
- **ABG** – can be normal in up to 18 %
  -Hypoxemia (74 %)
  -Widened alveolar-arterial gradient for oxygen (62 to 86%)
  -Respiratory alkalosis and hypocapnia (41%)

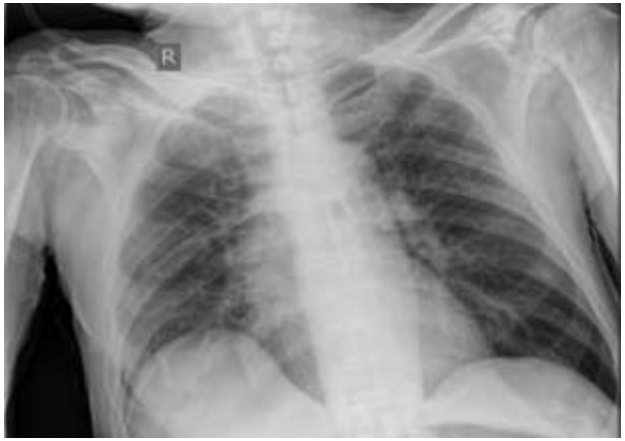
  -Hypercapnia, respiratory, and/or lactic acidosis: uncommon but can be seen in massive PE associated with obstructive shock and respiratory arrest.

- **Brain natriuretic peptide (BNP)** – limited diagnostic value , useful prognostically
- **Troponin** – Similarly

Circulation 2005; 112:e28.
Am J Respir Crit Care Med 2000; 162:2105.
Chest 1995;107:139.
Thromb Haemost 2006; 4:552.
J Am Coll Cardiol 2000; 36:1632.







CXR

- A normal chest radiograph can be seen in 12 to 22%
- Nonspecific abnormalities (eg, atelectasis, effusion)
- A Hampton's hump and Westermark's sign are rare but, when present, should raise the suspicion for PE
- A chest radiograph is typically performed in most patients suspected of PE to look for an alternative cause of the patient's symptoms

Chest 2000; 118:33
Chest 1991; 100:598

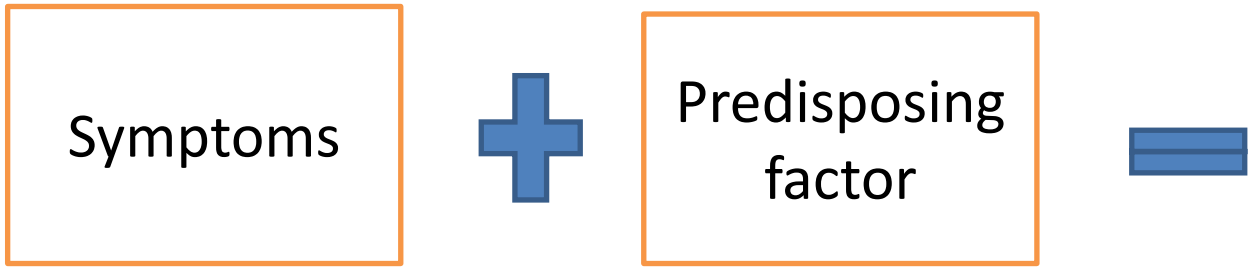
ECG

- ECG abnormalities, although common, are nonspecific.
- The most common findings are tachycardia and nonspecific ST-segment and T-wave changes (70%).

  Atrial fibrillation may be associated with acute PE.
- Abnormalities historically considered to be suggestive of PE (S1Q3T3 , RBBB) are uncommon (<10 %).

Eur Respir J 2005; 25:843.

Am J Cardiol 2000; 86:807.



important in determinine the clinical probability of the disease

- in 40% of patients with PE, **no** predisposing factors are found

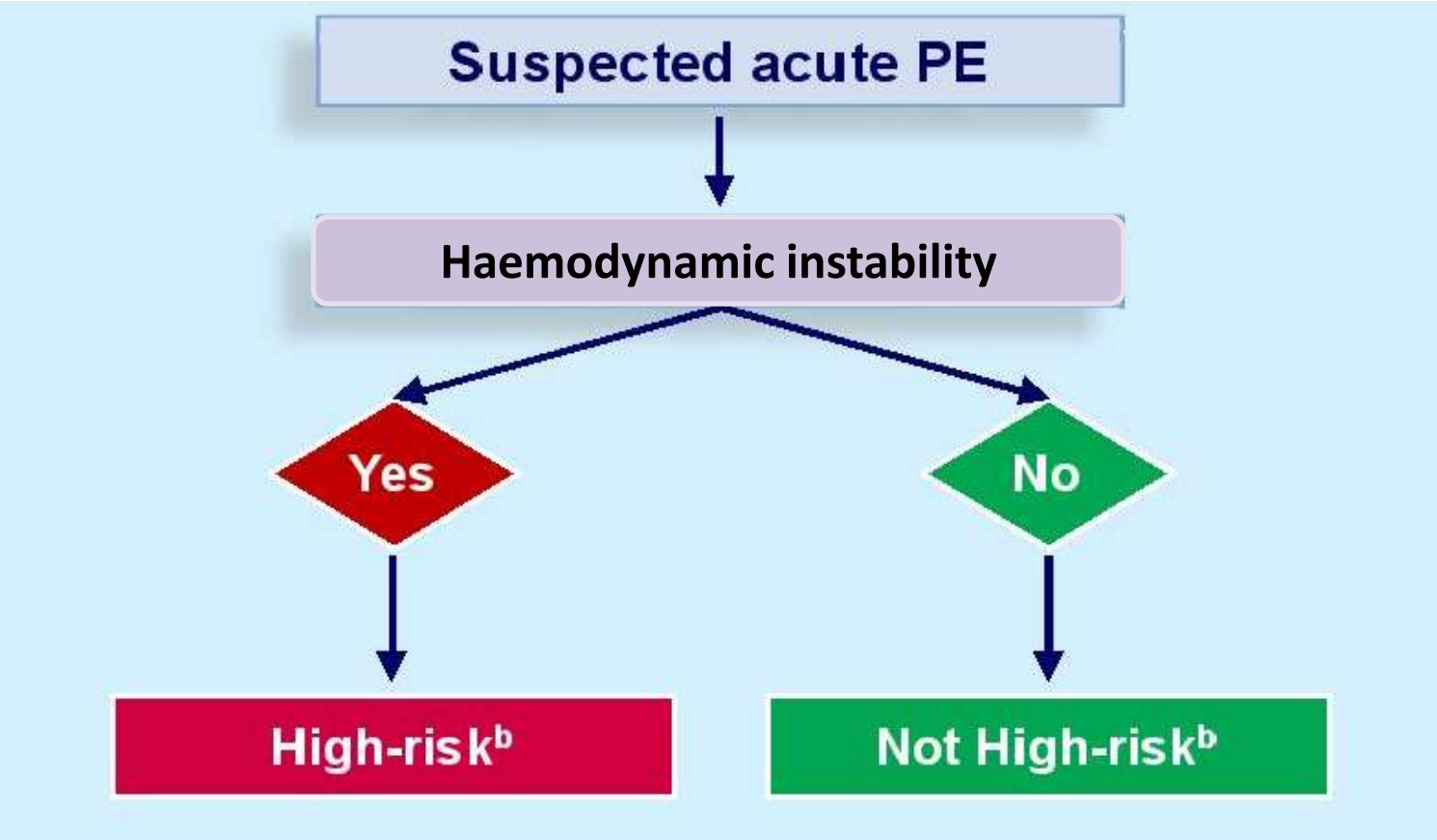
Διάγνωση

Κλινική υποψία !!!!!

Διερεύνηση για ΠΕ θα πρέπει να γίνεται σε όλες τις περιπτώσεις:

- Shock ή ανεξήγητης απώλειας συνείδησης
- Ανεξήγητου θωρακικού άλγους
- Ανεξήγητης δύσπνοιας
- Ανεξήγητης αιμόπτυσης

Initial risk stratisfication of PE



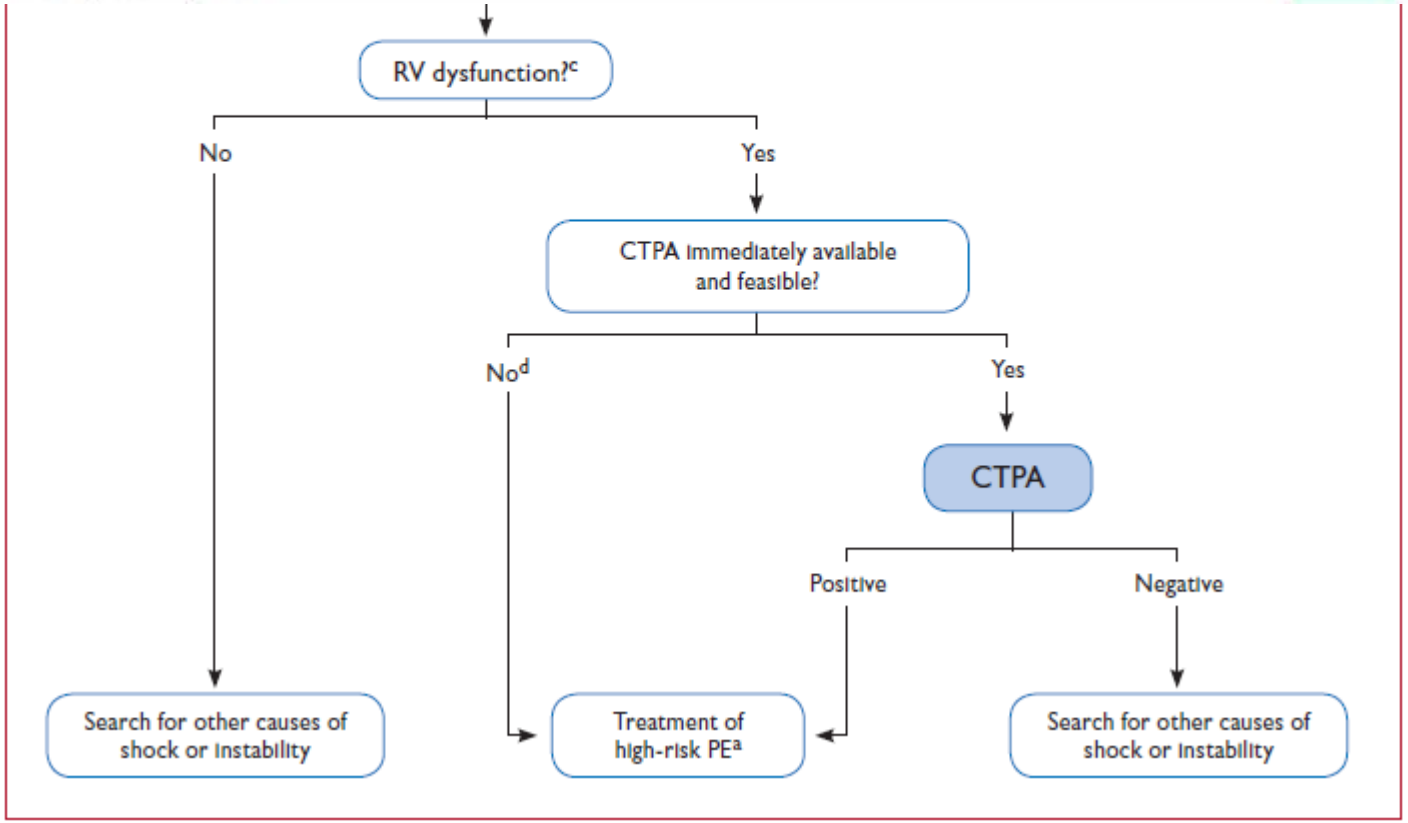
Definition of haemodynamic instability

(one of the following at presentation)

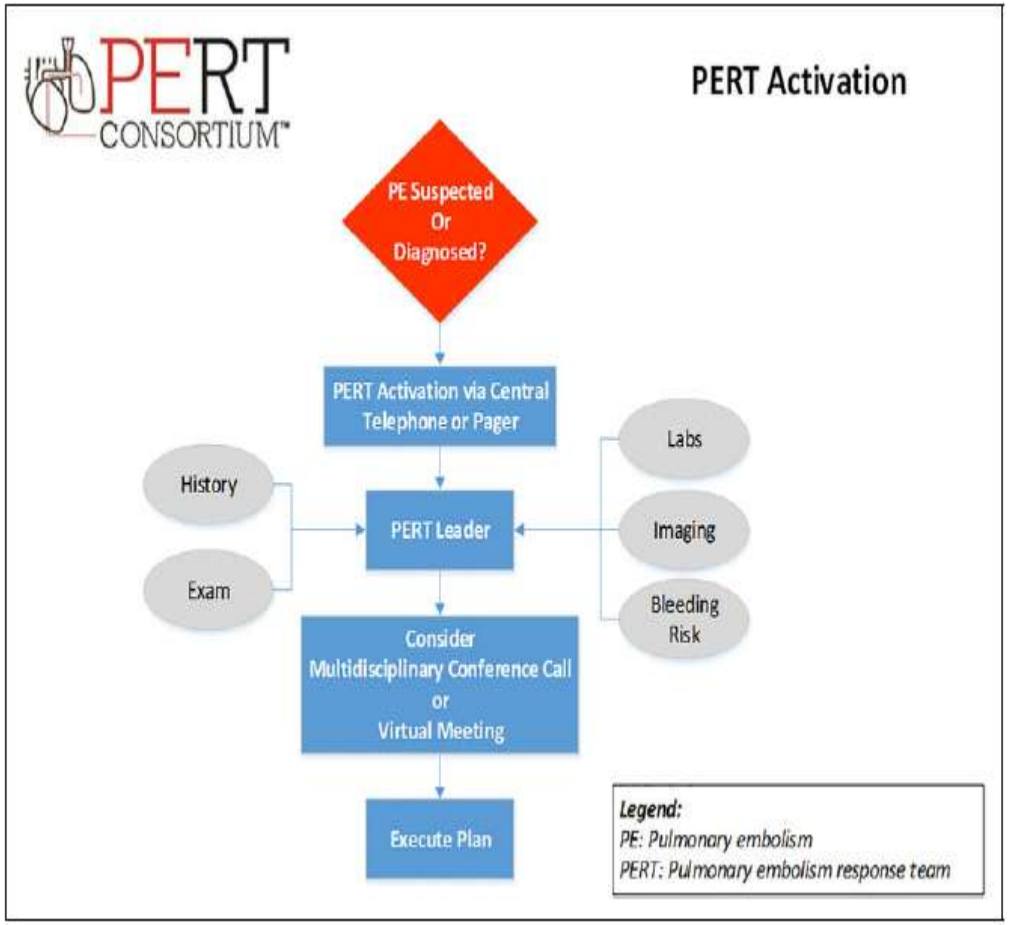
(1) Cardiac arrest	(2) Obstructive shock[68–70]	(3) Persistent hypotension
Need for cardiopulmonary resuscitation	Systolic BP < 90 mmHg or vasopressors required to achieve a BP ≥90 mmHg despite adequate filling status	Systolic BP < 90 mmHg or systolic BP drop ≥40 mmHg, lasting longer than 15 min and not caused by new-onset arrhythmia, hypovolaemia, or sepsis
	And	
	End-organ hypoperfusion (altered mental status; cold, clammy skin; oliguria/anuria; increased serum lactate)	

Diagnosis

Suspected PE with haemodynamic instability		
In suspected high-risk PE, as indicated by the presence of haemodynamic instability, bedside echocardiography or emergency CTPA (depending on availability and clinical circumstances) is recommended for diagnosis.[169]	I	C
It is recommended that i.v. anticoagulation with UFH, including a weight-adjusted bolus injection, be initiated without delay in patients with suspected high-risk PE.	I	C



Recommendation	Class[a]	Level[b]
Set-up of a multidisciplinary team and a programme for the management of high- and (in selected cases) intermediate-risk PE should be considered, depending on the resources and expertise available in each hospital.	IIa	C



Pulmonary Embolism Response Team structure and approaches vary by institution and may involve members from cardiac surgery, cardiac imaging, interventional and noninterventional cardiology, critical care, emergency medicine, hematology, clinical pharmacy, pulmonary, diagnostic and interventional radiology, vascular medicine, and vascular surgery.[2,10] A PERT is typically activated via a single contact

Clinical and Applied Thrombosis/Hemostasis
Volume 25: 1-16

Suspected PE in a patient without haemodynamic instability[a]

↓

Assess clinical probability of PE

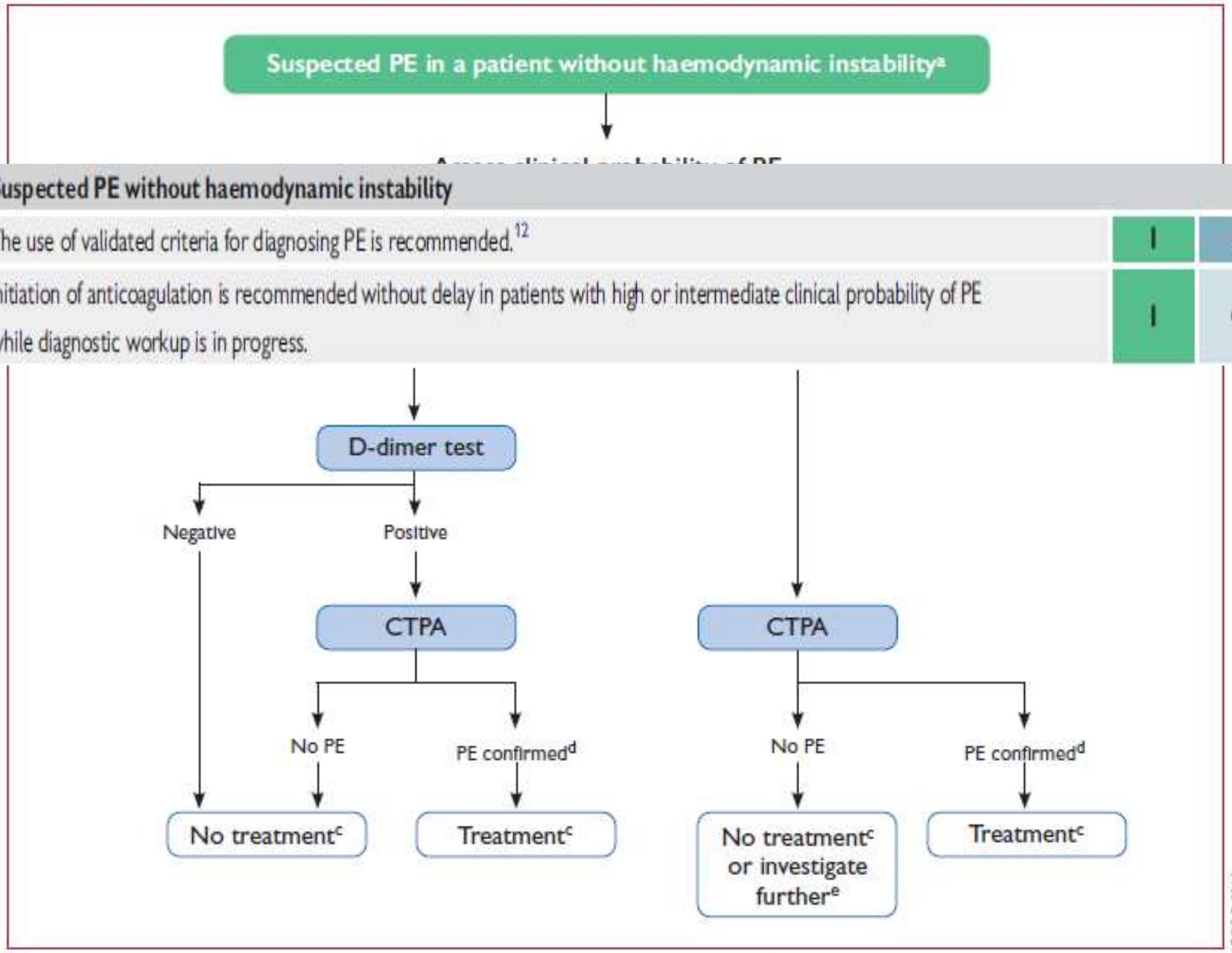
Clinical judgement or prediction rule[b]

Geneva

Items	Clinical decision rule points	
	Original version[91]	Simplified version[87]
Previous PE or DVT	3	1
Heart rate		
75–94 b.p.m.	3	1
≥95 b.p.m.	5	2
Surgery or fracture within the past month	2	1
Haemoptysis	2	1
Active cancer	2	1
Unilateral lower-limb pain	3	1
Pain on lower-limb deep venous palpation and unilateral oedema	4	1
Age >65 years	1	1
Clinical probability		
Three-level score		
Low	0–3	0–1
Intermediate	4–10	2–4
High	≥11	≥5
Two-level score		
PE-unlikely	0–5	0–2
PE-likely	≥6	≥3

Wells

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
Alterative diagnosis less likely than PE	3	1
Clinical probability		
Three-level score		
Low	0–1	N/A
Intermediate	2–6	N/A
High	≥7	N/A
Two-level score		
PE unlikely	0–4	0–1
PE likely	≥5	≥2


Suspected PE in a patient without haemodynamic instability[a]
Suspected PE without haemodynamic instability
The use of validated criteria for diagnosing PE is recommended.[12]
I
B
Initiation of anticoagulation is recommended without delay in patients with high or intermediate clinical probability of PE while diagnostic workup is in progress.
I
C
D-dimer test
Negative
Positive
CTPA
No PE
PE confirmed[d]
No treatment[c]
Treatment[c]
CTPA
No PE
PE confirmed[d]
No treatment[c] or investigate further[e]
Treatment[c]
©ESC 2019

Diagnosis

D-dimer		
Plasma D-dimer measurement, preferably using a highly sensitive assay, is recommended in outpatients/emergency department patients with low or intermediate clinical probability, or those that are PE-unlikely, to reduce the need for unnecessary imaging and irradiation.[101–103,122,164,171,173,174]	I	A
As an alternative to the fixed D-dimer cut-off, a negative D-dimer test using an age-adjusted cut-off (age × 10 µg/L, in patients aged >50 years) should be considered for excluding PE in patients with low or intermediate clinical probability, or those that are PE-unlikely.[106]	IIa	B
As an alternative to the fixed or age-adjusted D-dimer cut-off, D-dimer levels adapted to clinical probability should be considered to exclude PE.[107]	IIa	B
D-dimer measurement is not recommended in patients with high clinical probability, as a normal result does not safely exclude PE, even when using a highly sensitive assay.[175,176]	III	A

D-dimer levels adapted to clinical probability

3 clinical items of the Wells score

-signs of DVT

-haemoptysis + d-dimer levels

-PE more likely than an alternative diagnosis

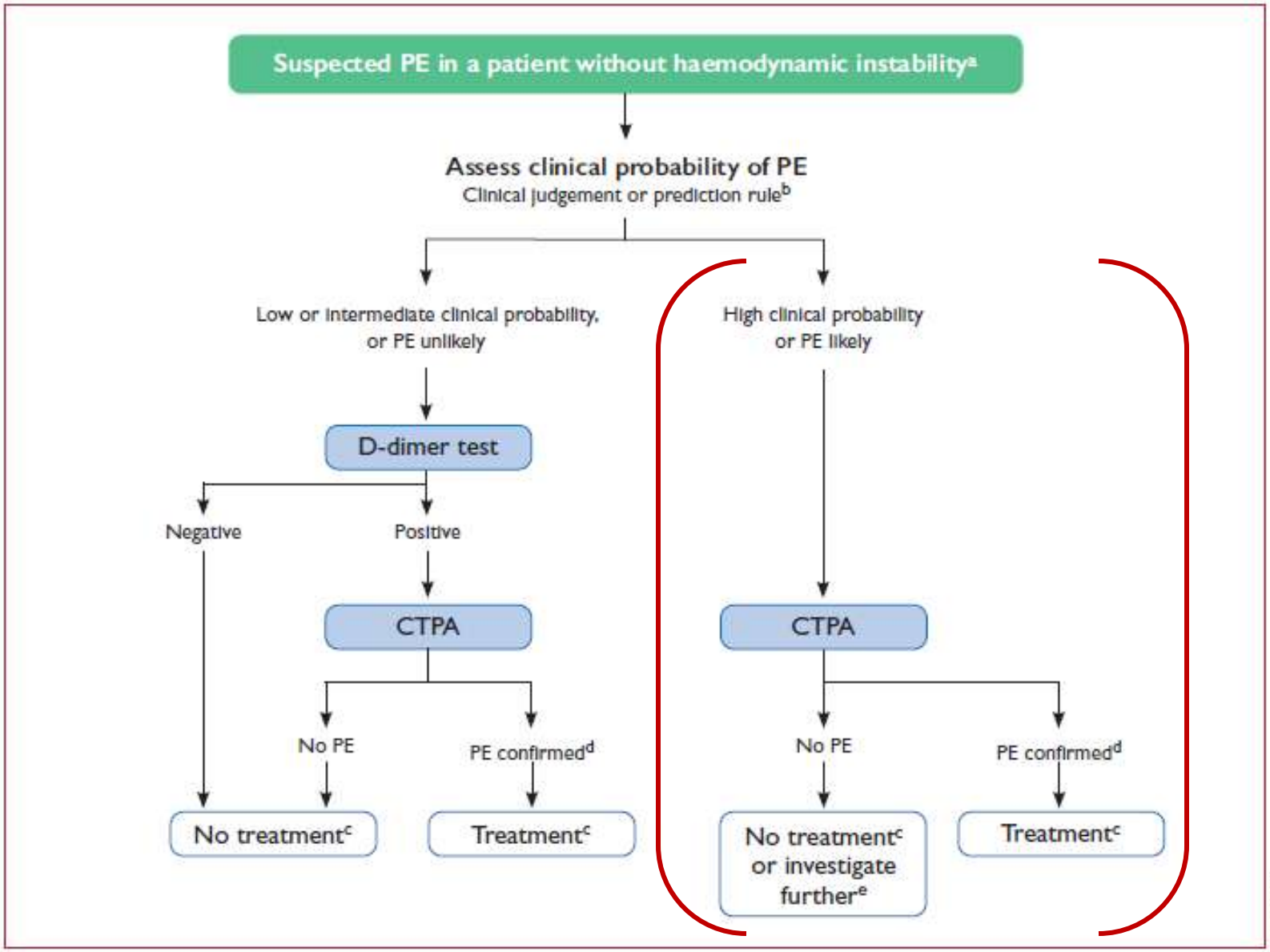
Without clinical items + d-dimer levels < 1000ng/ml } exclude PE

One or more clinical items +d-dimer levels < 500ng/ml

Η ασθενής

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
Alterative diagnosis less likely than PE	3	1
Clinical probability		
Three-level score		
Low	0–1	N/A
Intermediate	2–6	N/A
High	≥7	N/A
Two-level score		
PE unlikely	0–4	0–1
PE likely	≥5	≥2

Η ασθενής


Suspected PE in a patient without haemodynamic instability[a]
Assess clinical probability of PE
Clinical judgement or prediction rule[b]
Low or intermediate clinical probability, or PE unlikely
High clinical probability or PE likely
D-dimer test
Negative
Positive
CTPA
CTPA
No PE
PE confirmed[d]
No PE
PE confirmed[d]
No treatment[c]
Treatment[c]
No treatment[c] or investigate further[e]
Treatment[c]
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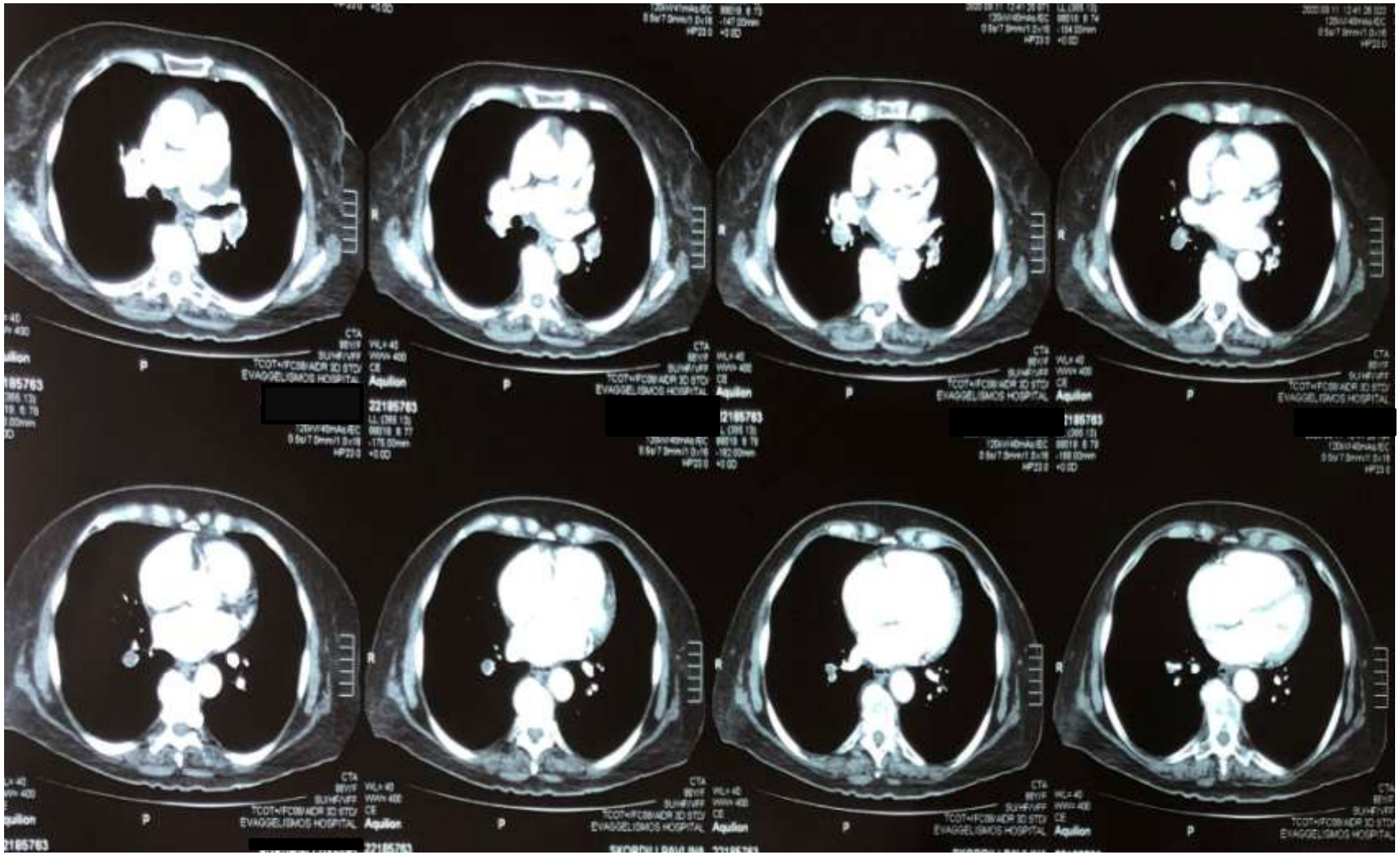
Η ασθενής υποβλήθηκε σε CTPA



Diagnosis

CTPA		
It is recommended to reject the diagnosis of PE (without further testing) if CTPA is normal in a patient with low or intermediate clinical probability, or who is PE-unlikely.[101,122,164,171]	I	A
It is recommended to accept the diagnosis of PE (without further testing) if CTPA shows a segmental or more proximal filling defect in a patient with intermediate or high clinical probability.[115]	I	B
It should be considered to reject the diagnosis of PE (without further testing) if CTPA is normal in a patient with high clinical probability or who is PE-likely.[171]	IIa	B
Further imaging tests to confirm PE may be considered in cases of isolated subsegmental filling defects.[115]	IIb	C
CT venography is not recommended as an adjunct to CTPA.[115,164]	III	B
V/Q scintigraphy		
It is recommended to reject the diagnosis of PE (without further testing) if the perfusion lung scan is normal.[75,122,134,174]	I	A
It should be considered to accept that the diagnosis of PE (without further testing) if the V/Q scan yields high probability for PE.[134]	IIa	B
A non-diagnostic V/Q scan should be considered as exclusion of PE when combined with a negative proximal CUS in patients with low clinical probability, or who are PE-unlikely.[75,122,174]	IIa	B
V/Q SPECT		
V/Q SPECT may be considered for PE diagnosis.[121,126–128]	IIb[d]	B

Diagnosis

Lower-limb CUS		
It is recommended to accept the diagnosis of VTE (and PE) if a CUS shows a proximal DVT in a patient with clinical suspicion of PE.[164,165]	I	A
If CUS shows only a distal DVT, further testing should be considered to confirm PE.[177]	IIa	B
If a positive proximal CUS is used to confirm PE, assessment of PE severity should be considered to permit risk-adjusted management.[178,179]	IIa	C
MRA		
MRA is not recommended for ruling out PE.[139,140]	III	A

Imaging test for diagnosis of PE

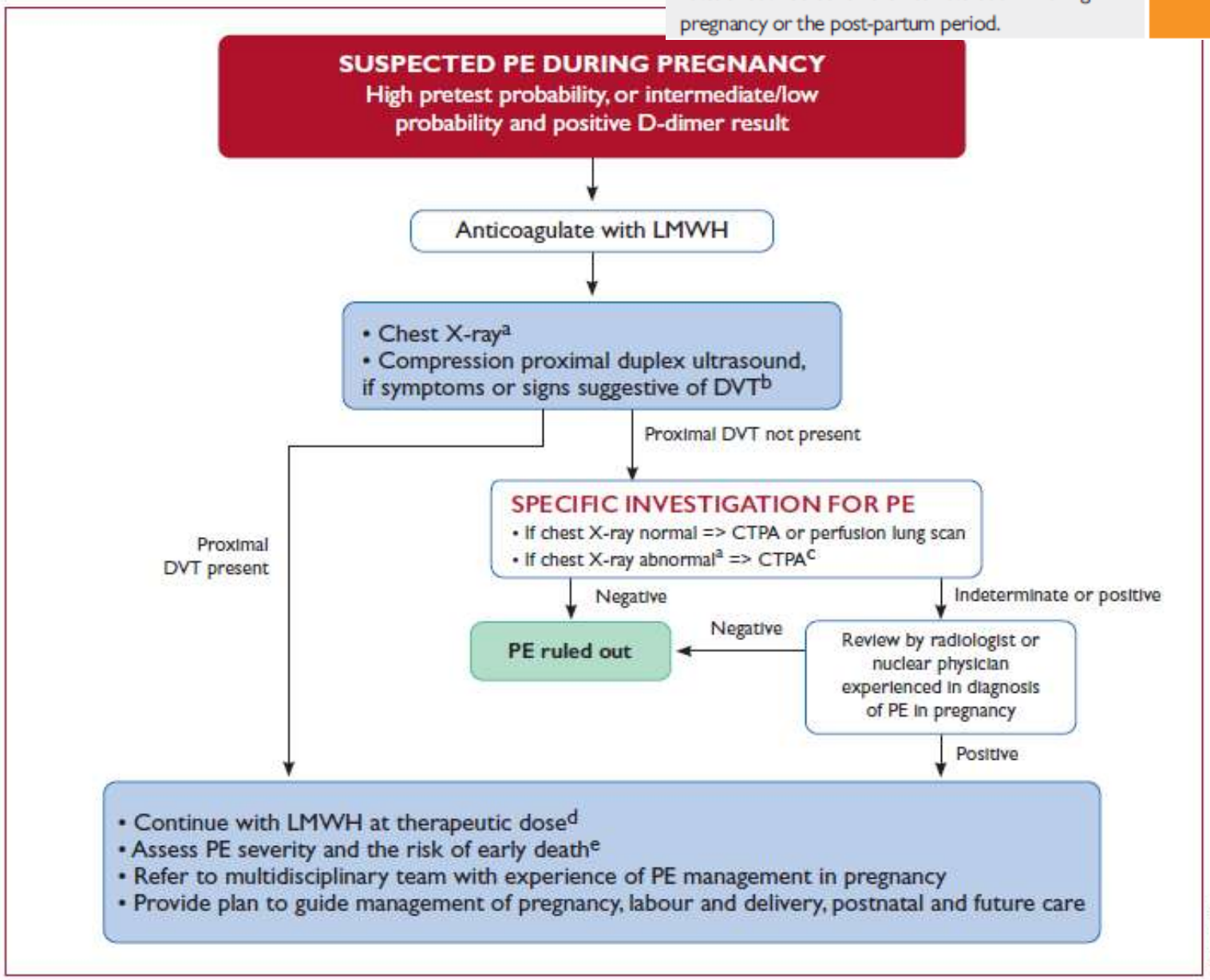
	Strengths	Weaknesses/limitations	Radiation issues[a]

CTPA	• Readily available around the clock in most centres
	• Excellent accuracy
	• Strong validation in prospective management outcome studies
	• Low rate of inconclusive results (3–5%)
	• May provide alternative diagnosis if PE excluded
	• Short acquisition time
		• Radiation exposure
		• Exposure to iodine contrast:
		  ○ limited use in iodine allergy and hyperthyroidism
		  ○ risks in pregnant and breastfeeding women
		  ○ contraindicated in severe renal failure
		• Tendency to overuse because of easy accessibility
		• Clinical relevance of CTPA diagnosis of subsegmental PE unknown
			• Radiation effective dose 3–10 mSv[b]
			• Significant radiation exposure to young female breast tissue

Planar V/Q scan	• Almost no contraindications • Relatively inexpensive • Strong validation in prospective management outcome studies	• Not readily available in all centres • Interobserver variability in interpretation • Results reported as likelihood ratios • Inconclusive in 50% of cases • Cannot provide alternative diagnosis if PE excluded	• Lower radiation than CTPA, effective dose ~2 mSv[b]
V/Q SPECT	• Almost no contraindications • Lowest rate of non-diagnostic tests (<3%) • High accuracy according to available data • Binary interpretation ('PE' vs. 'no PE')	• Variability of techniques • Variability of diagnostic criteria • Cannot provide alternative diagnosis if PE excluded • No validation in prospective management outcome studies	• Lower radiation than CTPA, effective dose ~2 mSv[b]
Pulmonary angiography	• Historical gold standard	• Invasive procedure • Not readily available in all centres	• Highest radiation, effective dose 10–20 mSv[b]

PE and pre

Recommendations	2014	2019
D-dimer measurement and clinical prediction rules should be considered to rule out PE during pregnancy or the post-partum period.	IIb	IIa



Assessment of severity of PE and the risk of early death

Recommendations for prognostic assessment

Recommendations	Class[a]	Level[b]
Initial risk stratification of suspected or confirmed PE, based on the presence of haemodynamic instability, is recommended to identify patients at high risk of early mortality.[218,219,235]	I	B
In patients without haemodynamic instability, further stratification of patients with acute PE into intermediate- and low-risk categories is recommended.[179,218,219,235]	I	B
In patients without haemodynamic instability, use of clinical prediction rules integrating PE severity and comorbidity, preferably the PESI or sPESI, should be considered for risk assessment in the acute phase of PE.[178,226,229]	IIa	B
Assessment of the RV by imaging methods[c] or laboratory biomarkers[d] should be considered, even in the presence of a low PESI or a negative sPESI.[234]	IIa	B
In patients without haemodynamic instability, use of validated scores combining clinical, imaging, and laboratory PE-related prognostic factors may be considered to further stratify the severity of the acute PE episode.[218–223]	IIb	C

PESI

Parameter	Original version[226]	Simplified version[229]
Age	Age in years	1 point (if age >80 years)
Male sex	+10 points	–
Cancer	+30 points	1 point
Chronic heart failure	+10 points	1 point
Chronic pulmonary disease	+10 points	
Pulse rate ≥110 b.p.m.	+20 points	1 point
Systolic BP <100 mmHg	+30 points	1 point
Respiratory rate >30 breaths per min	+20 points	–
Temperature <36°C	+20 points	–
Altered mental status	+60 points	–
Arterial oxyhaemoglobin saturation <90%	+20 points	1 point

Risk strata[a]		
	Class I: ≤65 points very low 30 day mortality risk (0–1.6%) **Class II: 66–85 points** low mortality risk (1.7–3.5%)	**0 points** = 30 day mortality risk 1.0% (95% CI 0.0–2.1%)
	Class III: 86–105 points moderate mortality risk (3.2–7.1%) **Class IV: 106–125 points** high mortality risk (4.0–11.4%) **Class V: >125 points** very high mortality risk (10.0–24.5%)	**≥1 point(s)** = 30 day mortality risk 10.9% (95% CI 8.5–13.2%)

Assessment of severity of PE and the risk of early death

Classification of pulmonary embolism severity and the risk of early (in-hospital or 30 day) death

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

- u/s καρδιάς:

•Αριστερή κοιλία φυσιολογικών εσωτερικών διαστάσεων με καλή συστολική και επηρεασμένη διαστολική λειτουργία,χωρίς εμφανείς τμηματικές διαταραχές κινητικότητας.

•Φυσιολογικών διαστάσεων και λειτουργικότητας δεξιά κοιλία.

•Ήπια διάταση αριστερού κόλπου.

•Φυσιολογικών διαστάσεων δεξιός κόλπος.

•Φυσιολογικών διαστάσεων αορτική ρίζα και ανιούσα αορτή.

•Τρίπτυχη αορτική βαλβίδα με φυσιολογικής σύστασης μηνοειδείς πτυχές και καλή διάνοιξη.

•Λοιπές βαλβίδες χωρίς δομικές αλλοιώσεις.

- Τροπονίνη 8pg/ml

Ερώτηση 2

- Ποια είναι η βαρύτητα της ΠΕ και ο κίνδυνος πρώιμου θανάτου;

1. Ενδιάμεσου χαμηλού κινδύνου
2. Ενδιάμεσου υψηλού κινδύνου
3. Υψηλού κινδύνου
4. Χαμηλού κινδύνου

Η ασθενής

Parameter	Original version[226]	Simplified version[229]
Age	Age in years	1 point (if age >80 years)
Male sex	+10 points	–
Cancer	+30 points	1 point
Chronic heart failure	+10 points	1 point
Chronic pulmonary disease	+10 points	
Pulse rate ≥110 b.p.m.	+20 points	1 point
Systolic BP <100 mmHg	+30 points	1 point
Respiratory rate >30 breaths per min	+20 points	–
Temperature <36°C	+20 points	–
Altered mental status	+60 points	–
Arterial oxyhaemoglobin saturation <90%	+20 points	1 point

Risk strata[a]		
	Class I: ≤65 points very low 30 day mortality risk (0–1.6%) **Class II: 66–85 points** low mortality risk (1.7–3.5%)	**0 points** = 30 day mortality risk 1.0% (95% CI 0.0–2.1%)
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Η ασθενής

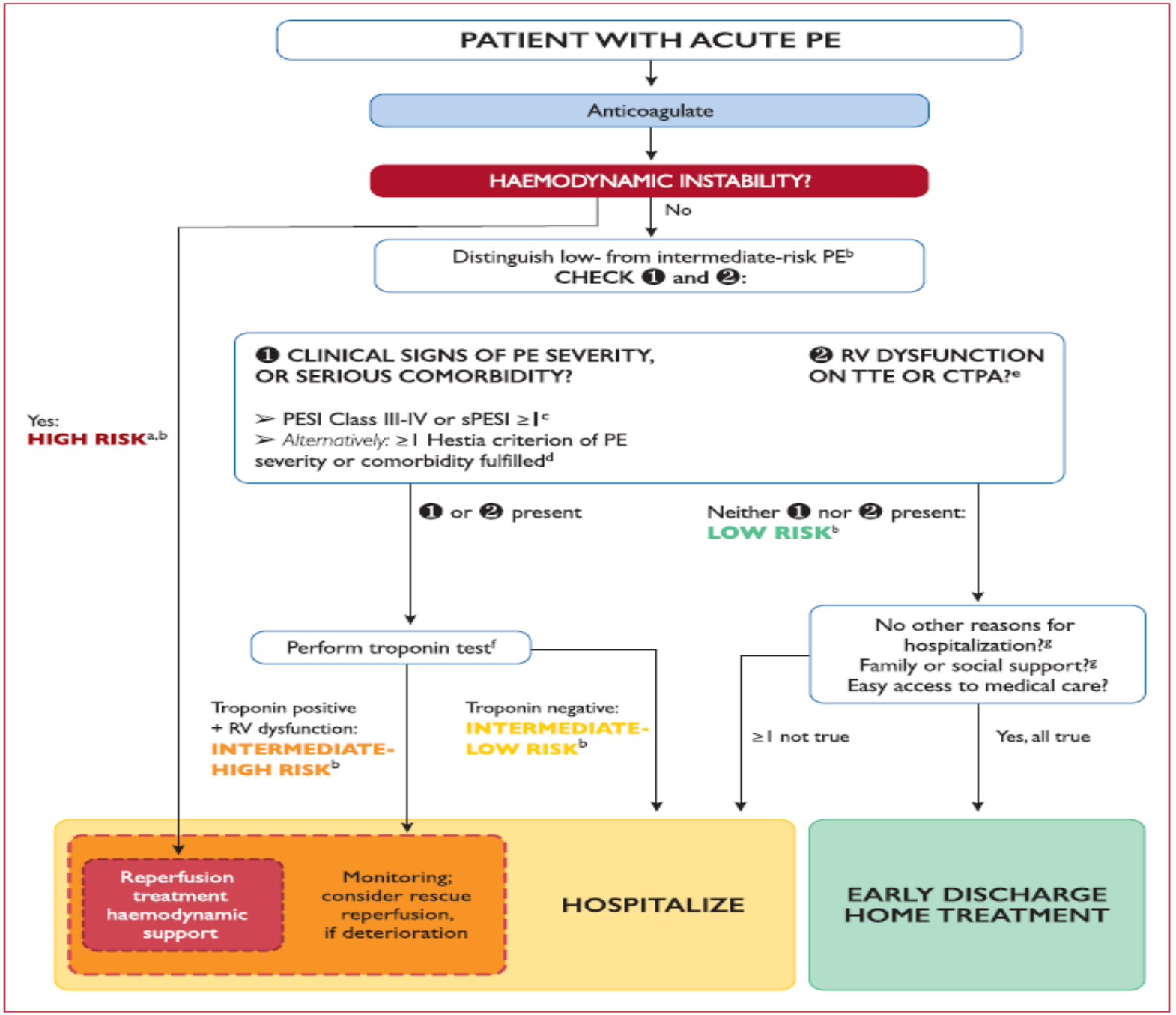
Table 8 Classification of pulmonary embolism severity and the risk of early (in-hospital or 30 day) death

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

Ερώτηση 3

- Ποια είναι η επόμενη κίνησή σας;

1. Θα της συνταγογραφήσω LMWH και θα της δώσω οδηγίες
2. Θα της συνταγογραφήσω NOAC και θα της δώσω οδηγίες
3. Θα την εισάγω στο νοσοκομείο για παρακολούθηση
4. Θα την εισάγω στην κλινική και θα ενημερώσω τη ΜΕΘ



A revised algorithm

European guidelines: Patients with an sPESI score of 0 can be treated at home, providing that proper follow-up and anticoagulant therapy can be provided.

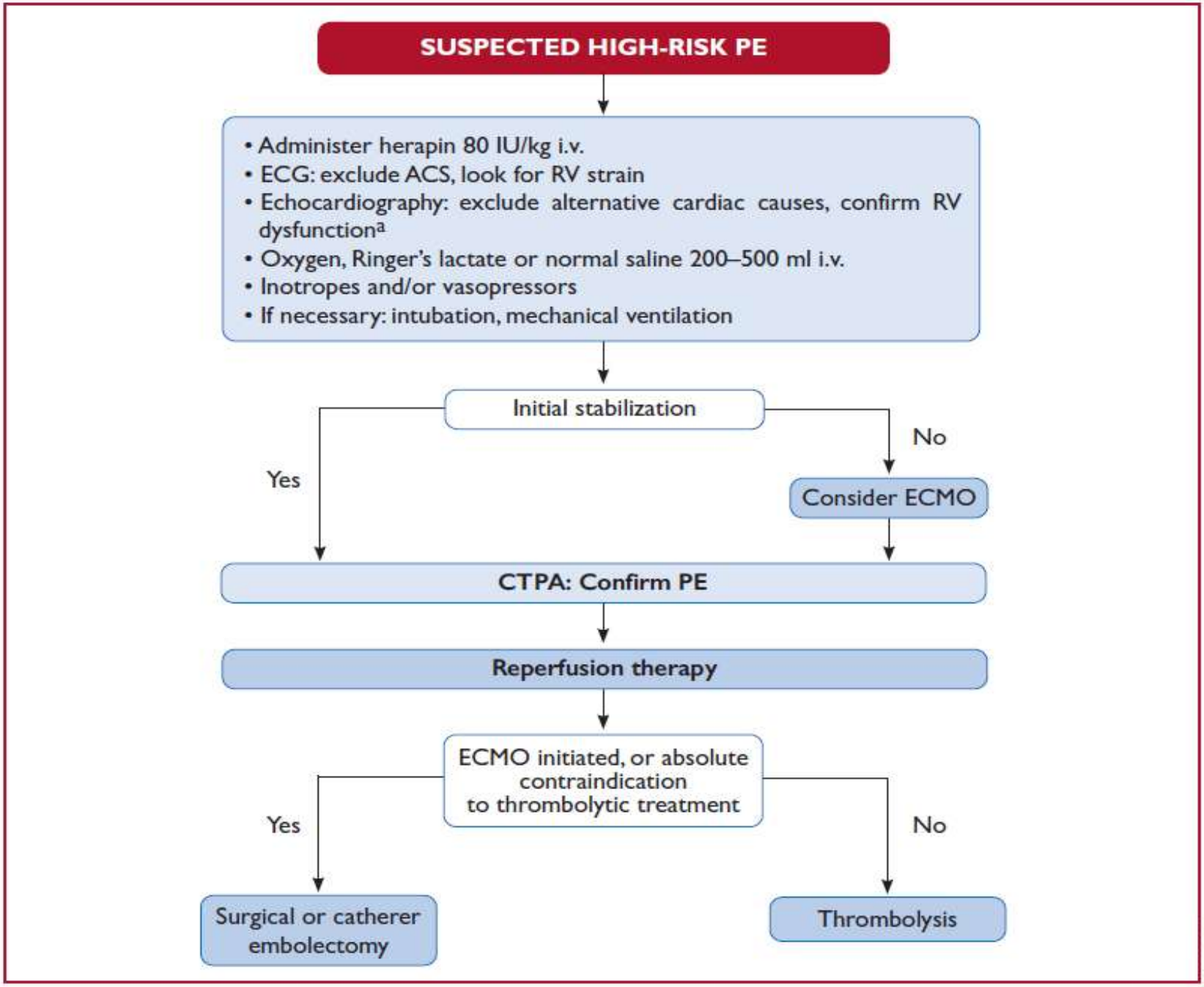
American guidelines: do not require a predefined score, and advise using pragmatic criteria such as those in the Hestia Study.

HOME-PE

- examined whether a strategy based on the Hestia criteria was at least as safe as a strategy based on the sPESI score to select patients for home treatment
- a randomised, open-label non-inferiority trial, 1,974 patients
- primary outcome was a composite of recurrent VTE, major bleeding, and all-cause death within 30 days
- The Hestia strategy was non-inferior to the sPESI strategy: the primary outcome occurred in 3.8% of the Hestia group and 3.6% of the sPESI group (p=0.005).

Hestia exclusion criteria for outpatient management

Criterion/question
Is the patient haemodynamically unstable?[a]
Is thrombolysis or embolectomy necessary?
Active bleeding or high risk of bleeding?[b]
More than 24 h of oxygen supply to maintain oxygen saturation >90%?
Is PE diagnosed during anticoagulant treatment?
Severe pain needing i.v. pain medication for more than 24 h?
Medical or social reason for treatment in the hospital for >24 h (infection, malignancy, or no support system)?
Does the patient have a CrCl of <30 mL/min?[c]
Does the patient have severe liver impairment?[d]
Is the patient pregnant?
Does the patient have a documented history of heparin-induced thrombocytopenia?



Thoroughly revised section on haemodynamic and respiratory support for high-risk PE (Section 6.1).

A dedicated management algorithm is proposed for high-risk PE (*Supplementary Figure 1*).

Treatment

It is recommended that anticoagulation with UFH, including a weight-adjusted bolus injection, be initiated without delay in patients with high-risk PE.	I	C
Systemic thrombolytic therapy is recommended for high-risk PE.[282]	I	B
Surgical pulmonary embolectomy is recommended for patients with high-risk PE, in whom thrombolysis is contraindicated or has failed.[d 281]	I	C
Percutaneous catheter-directed treatment should be considered for patients with high-risk PE, in whom thrombolysis is contraindicated or has failed.[d]	IIa	C
Norepinephrine and/or dobutamine should be considered in patients with high-risk PE.	IIa	C
ECMO may be considered, in combination with surgical embolectomy or catheter-directed treatment, in patients with PE and refractory circulatory collapse or cardiac arrest.[d 252]	IIb	C

Recommendations for acute phase treatment of high risk PE

Treatment

Initiation of anticoagulation		
Initiation of anticoagulation is recommended without delay in patients with high or intermediate clinical probability of PE,[c] while diagnostic workup is in progress.	I	C
If anticoagulation is initiated parenterally, LMWH or fondaparinux is recommended (over UFH) for most patients.[262,309–311]	I	A
When oral anticoagulation is started in a patient with PE who is eligible for a NOAC (apixaban, dabigatran, edoxaban, or rivaroxaban), a NOAC is recommended in preference to a VKA.[260,261,312–314]	I	A
When patients are treated with a VKA, overlapping with parenteral anticoagulation is recommended until an INR of 2.5 (range 2.0–3.0) is reached.[315,316]	I	A
NOACs are not recommended in patients with severe renal impairment,[d] during pregnancy and lactation, and in patients with antiphospholipid antibody syndrome.[260,261,312–314]	III	C

Recommendations for acute phase treatment of intermediate or low risk PE

Treatment

Recommendations for acute phase treatment of intermediate or low PE

Reperfusion treatment		
Rescue thrombolytic therapy is recommended for patients with haemodynamic deterioration on anticoagulation treatment.[282]	I	B
As an alternative to rescue thrombolytic therapy, surgical embolectomy[e] or percutaneous catheter-directed treatment[e] should be considered for patients with haemodynamic deterioration on anticoagulation treatment.	IIa	C
Routine use of primary systemic thrombolysis is not recommended in patients with intermediate- or low-risk PE.[cf 179]	III	B

Recommendations	2014	2019
Rescue thrombolytic therapy is recommended for patients who deteriorate haemodynamically.	IIa	I
Surgical embolectomy or catheter-directed treatment should be considered as alternatives to rescue thrombolytic therapy for patients who deteriorate haemodynamically.	IIb	IIa

Treatment

Recommendations for inferior vena cava filters

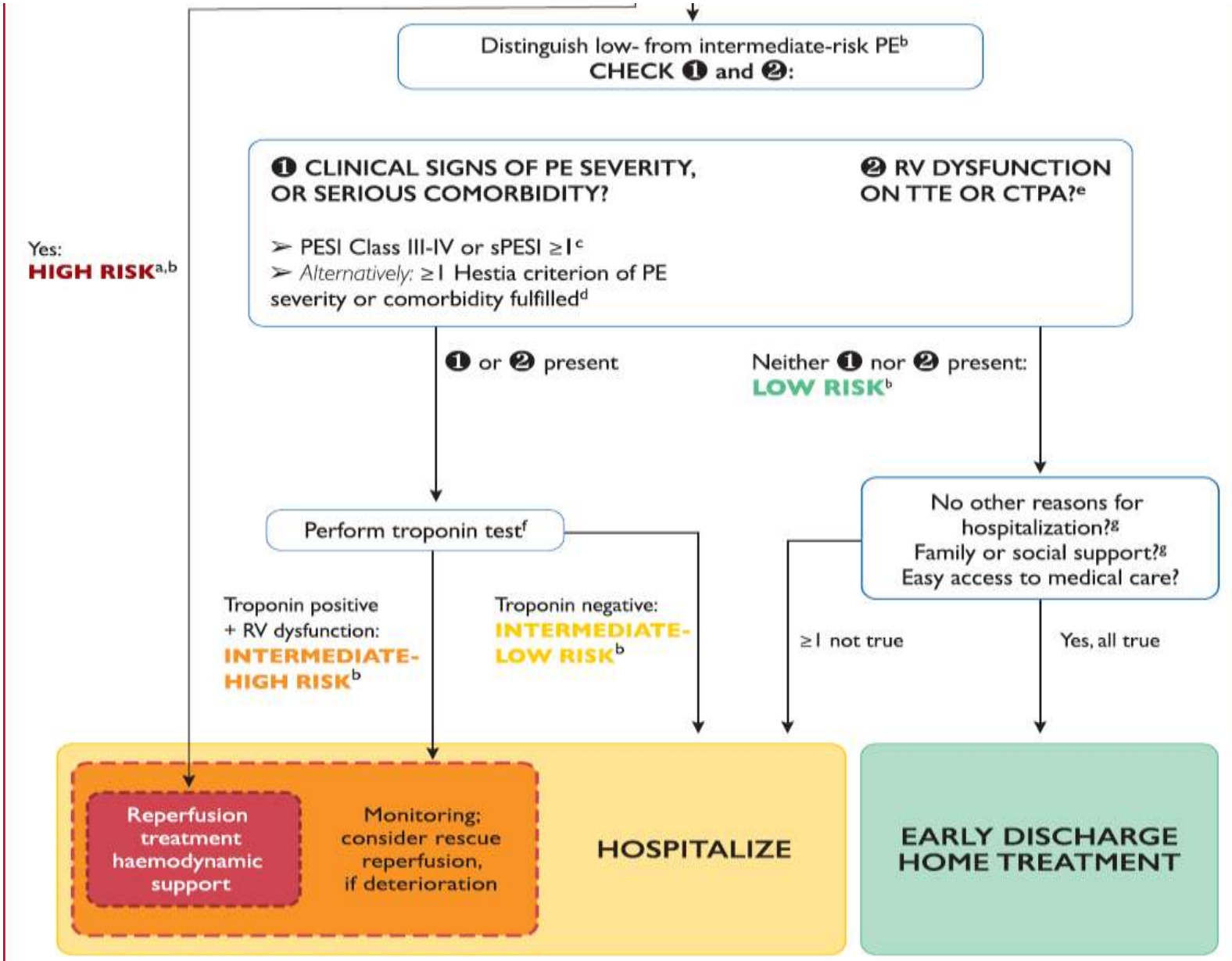
Recommendations	Class[a]	Level[b]
IVC filters should be considered in patients with acute PE and absolute contraindications to anticoagulation.	IIa	C
IVC filters should be considered in cases of PE recurrence despite therapeutic anticoagulation.	IIa	C
Routine use of IVC filters is not recommended.[302–304]	III	A

- Η ασθενής εισήχθη στην κλινική και ετέθη σε πλήρη αντιπηκτική αγωγή.
- Τις επόμενες ώρες εμφάνισε πάλι αίσθημα παλμών και μετρήθηκαν HR 140/min, 150/70mmHg, RR 16/min, Sat 96% (FiO2 21%)
- ΗΚΓ: ΚΜ

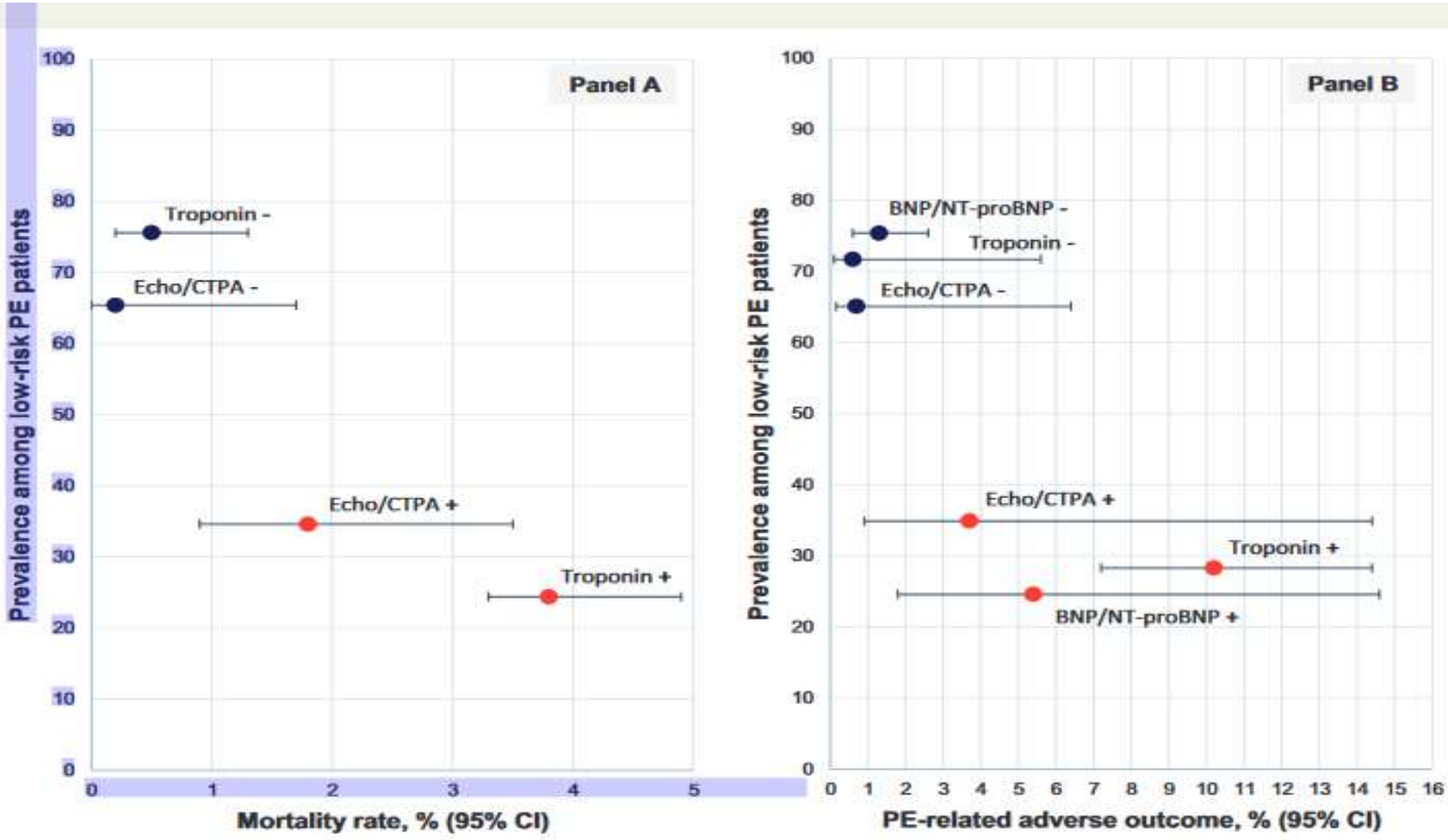
Ερώτηση 4

- Τι θα κάνετε;

1. Δεν χρειάζεται περαιτέρω διερεύνηση και αντιμετώπιση– έχει ΠΕ και λαμβάνει ήδη αντιπηκτικά – θα την παρακολουθήσω
2. Κάνω νέα CTPA
3. Επανεκτιμώ τη βαρύτητα της εμβολής (επαναληπτικό U/S, τροπονίνη)
4. Ζητώ μεταφορά στην καρδιολογική κλινική


Distinguish low- from intermediate-risk PE[b]
CHECK ❶ and ❷:
❶ CLINICAL SIGNS OF PE SEVERITY, OR SERIOUS COMORBIDITY?
➢ PESI Class III-IV or sPESI ≥1[c]
➢ Alternatively: ≥1 Hestia criterion of PE severity or comorbidity fulfilled[d]
❷ RV DYSFUNCTION ON TTE OR CTPA?[e]
Yes:
HIGH RISK[a,b]
❶ or ❷ present
Neither ❶ nor ❷ present:
LOW RISK[b]
Perform troponin test[f]
No other reasons for hospitalization?[g]
Family or social support?[g]
Easy access to medical care?
Troponin positive + RV dysfunction:
INTERMEDIATE-HIGH RISK[b]
Troponin negative:
INTERMEDIATE-LOW RISK[b]
≥1 not true
Yes, all true
Reperfusion treatment haemodynamic support
Monitoring; consider rescue reperfusion, if deterioration
HOSPITALIZE
EARLY DISCHARGE HOME TREATMENT

RV dysfunction was associated with early mortality



European Heart Journal (2019)40, 902–910

Low risk patients may deteriorate few hours later due to the decompensation of previously unnoticed RV dysfunction

Assessment of the RV by imaging or laboratory biomarkers should be considered, even in the presence of a low PESI or a sPESI of 0.	IIa

Messages from guidelines

Diagnosis	Class[a]
In suspected high-risk PE, perform bedside echocardiography or emergency CTPA (depending on availability and clinical circumstances) for diagnosis.	I
In suspected high-risk PE, initiate intravenous anticoagulation with UFH without delay, including a weight-adjusted bolus injection.	I
In suspected PE without haemodynamic instability, initiate anticoagulation in case of high or intermediate clinical probability, while diagnostic workup is in progress.	I
Base the diagnostic strategy on clinical probability, using either clinical judgement or a validated prediction rule.	I
Measure D-dimers in plasma, preferably with a highly sensitive assay, in outpatients/emergency department patients with low or intermediate clinical probability, or who are PE-unlikely.	I
Reject the diagnosis of PE (without further testing) if CTPA is normal in a patient with low or intermediate clinical probability, or if the patient is PE-unlikely.	I
Reject the diagnosis of PE (without further testing) if the perfusion lung scan is normal.	I
Accept the diagnosis of PE if CTPA shows a segmental or more proximal filling defect in a patient with intermediate or high clinical probability.	I
Accept the diagnosis of VTE if CUS shows a proximal DVT in a patient with clinical suspicion of PE.	I

Messages from guidelines

Risk assessment	
Stratify patients with suspected or confirmed PE, based on the presence of haemodynamic instability, to identify those at high risk of early mortality.	I
In patients without haemodynamic instability, further stratify PE into intermediate- and low-risk categories.	I
Treatment in the acute phase	
Administer systemic thrombolytic therapy to patients with high-risk PE.	I
Surgical pulmonary embolectomy for patients with high-risk PE, in whom recommended thrombolysis is contraindicated or has failed.	I
If anticoagulation is initiated parenterally in a patient without haemodynamic instability, prefer LMWH or fondaparinux over UFH.	I
When oral anticoagulation is initiated in a patient with PE who is eligible for a NOAC (apixaban, dabigatran, edoxaban, or rivaroxaban), prefer a NOAC.	I
Administer rescue thrombolytic therapy to a patient with haemodynamic deterioration on anticoagulation treatment.	I
Do not routinely administer systemic thrombolysis as primary treatment in patients with intermediate- or low-risk PE.	III
Do not routinely use inferior vena cava filters.	III

Avoiding overuse of diagnostic tests

Diagnosis, Imaging, and Risk Stratification of Pulmonary Embolism

2. Use a combination of low- or intermediate- pretest probability, the PERC rule and D-dimer testing to rule out PE without imaging.

Pulmonary Embolism Rule-out Criteria (PERC)

- age < 50yr
- pulse < 100beats/min
- SaO2 >94%
- no haemoptysis
- no recent trauma or surgery
- no history of VTE
- no oral hormone use

prospective validation study, randomized non inferiority validation study

The low overall prevalence of PE in these studies does not support the generalizability of the results