Management of acute pulmonary embolism with shock

Mohamed KHEDR, MD
Al-Galaa Military Medical Complex

Case presentation

Male pt ,50 years old , not diabetic not hypertensive , presented to ER with difficult rapid breathing, cold extremities, chest pain and diaphoresis , giving past history of being immobilized for the last three weeks post orthopedic surgery .

General examination

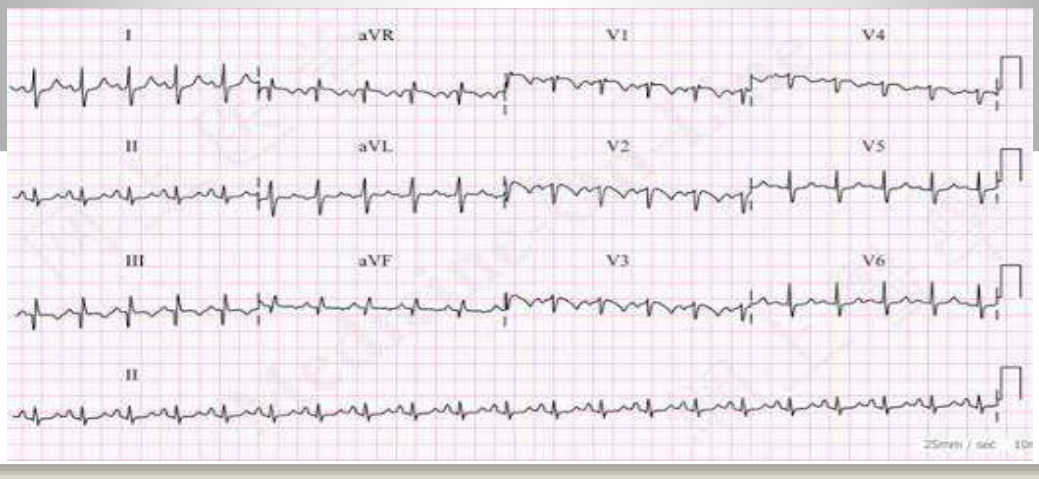
JVP : +++
Pulse : 120bpm regular
Blood pressure : 70\40
Heart auscultation : pan systolic murmur over lower left sternal border
Chest auscultation : clear
Lower limb : tender red calf muscle of right lower limb

What is the differential diagnosis

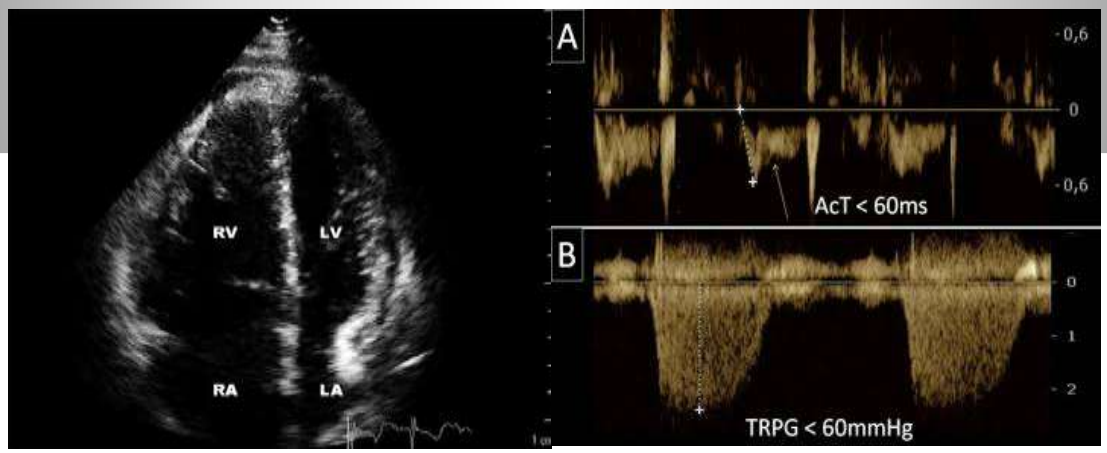
Acute massive pulmonary embolism
Cardiac Tamponade
Tension Pneumothorax
Acute myocardial infarction
Aortic dissection
Acute valvular dysfunction

Investigations showed :

ECG : sinus tachycardia , RV strain pattern , S1Q3T3

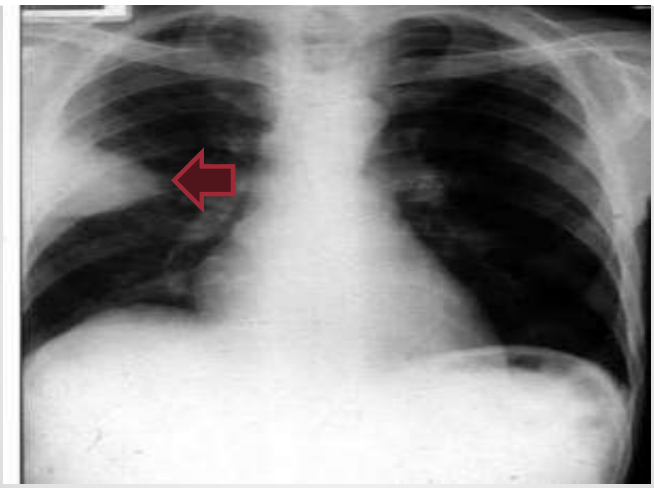


Echocardiography: right ventricular dilatation , hypokinetic RV free wall , tricuspid regurge , ERVSP=40mmHg, pulmonary acceleration time : 50 ms



Laboratory investigations:

ABG: Hypoxic hypocapnic alkalotic
Troponin: positive
D-dimer: positive
S. creatinine: 1.4 mg/ dl
CBC: normal hemoglobin and platelet count with leuckocytosis



Chest X-ray: lung olegemia with wedge shaped opacity

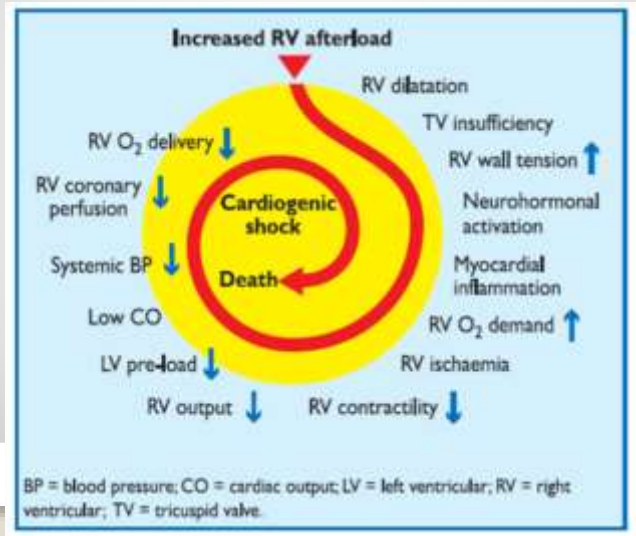
So..

The most probable diagnosis is:

Acute pulmonary embolism with shock

What to do according to recent ESC guidelines??

Pathophysiology



Strong risk factors (odds ratio >10)
Fracture of lower limb
Hospitalization for heart failure or atrial fibrillation/flutter (within previous 3 months)
Hip or knee replacement
Major trauma
Myocardial infarction (within previous 3 months)
Previous venous thromboembolism
Spinal cord injury

Items	Clinical decision rule points	
Wells rule	**Original version[95]**	**Simplified version[107]**
Previous PE or DVT	1.5	1
Heart rate ≥100 b.p.m.	1.5	1
Surgery or immobilization within the past four 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		
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

Revised Geneva score	Original version[11]	Simplified version[118]
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

Diagnosis

Recommendations	Class	Level
Suspected PE with shock or hypotension		
In suspected high-risk PE, as indicated by the presence of shock or hypotension, emergency CT angiography or bedside transthoracic echocardiography (depending on availability and clinical circumstances) is recommended for diagnostic purposes.	I	C
In patients with suspected high-risk PE and signs of RV dysfunction who are too unstable to undergo confirmatory CT angiography, bedside search for venous and/or pulmonary artery thrombi with CUS and/or TOE may be considered to further support the diagnosis of PE, if immediately available.	IIb	C
Pulmonary angiography may be considered in unstable patients admitted directly to the catheterization laboratory, in case coronary angiography has excluded an acute coronary syndrome and PE emerges as a probable diagnostic alternative.	IIb	C

www.escardio.org/guidelines

European Heart Journal (2014):doi:10.1093/eurheartj/ehu283

CT scan

-Normal CT angiography safely excludes PE in patients with low or intermediate clinical probability (PE unlikely). **I**
-Normal CT angiography may safely exclude PE in patients with high clinical probability **IIa**
-CT angiography showing a segmental or more proximal thrombus confirms PE. **I**
-Further testing to confirm PE may be considered in case of isolated sub-segmental clots. **IIb**

ECHO

Finding:
- RV overload…. RV thrombus
….. RV:LV ratio> 1
…. RVSP> 30 mmhg
…. Abnormal IVS motion
- 60/60 sign….PAT<60 ms + RVSP <60 mmHg
-Mcconnel sign… hypokinesia with apex sparing
- Thrombus in PA by TEE

Prognostic assessment

-Clinical parameter (pulmonary embolism severity index)

-Imaging of the RV by echo or CT scan

-Biomarkers

Prognostic assessment

Recommendations	Class	Level
Initial risk stratification of suspected or confirmed PE based on the presence of shock or persistent hypotension is recommended to identify patients at high-risk of early mortality.	I	B
In patients not at high-risk, use of a validated clinical risk prediction score, preferably the PESI or sPESI, should be considered to distinguish between low- and intermediate-risk PE.	IIa	B
In patients at intermediate risk, assessment of the right ventricle with echo-cardiography or CT, and of myocardial injury using a laboratory biomarker, should be considered for further risk stratification.	IIa	B

www.escardio.org/guidelines

European Heart Journal (2014):doi:10.1093/eurheartj/ehu283

Original and simplified pulmonary embolism severity index (PESI)

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

www.escardio.org/guidelines

European Heart Journal (2014):doi:10.1093/eurheartj/ehu283

Original and simplified pulmonary embolism severity index (PESI)

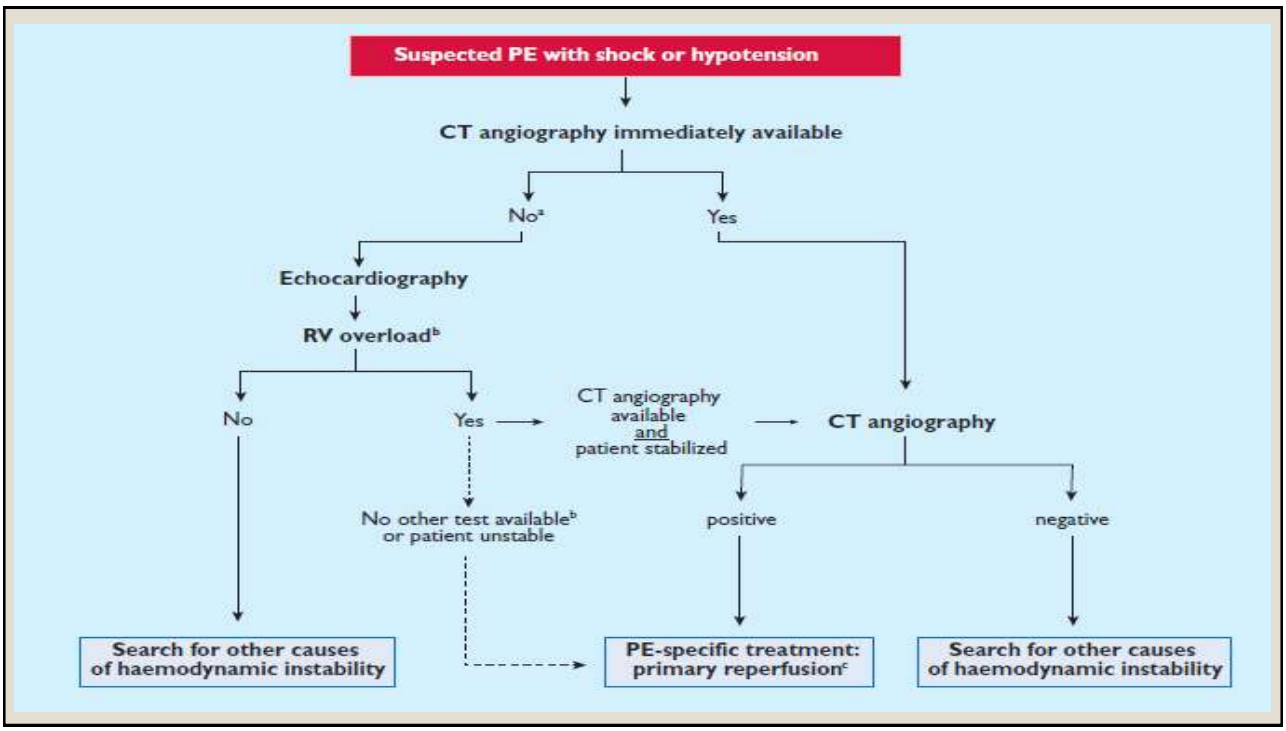
Parameter	Original version	Simplified version
	Risk strata	
	Class I: ≤65 points very low 30-day mortality risk (0-1.6%) **Class II: 66-85 points** low mortality risk (1.7-3.5%)	**0 points** = 30-day mortality risk 1.0% (95% CI 0.0%-2.1%)
	Class III: 86-105 points moderate mortality risk (3.2-7.1%) **Class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

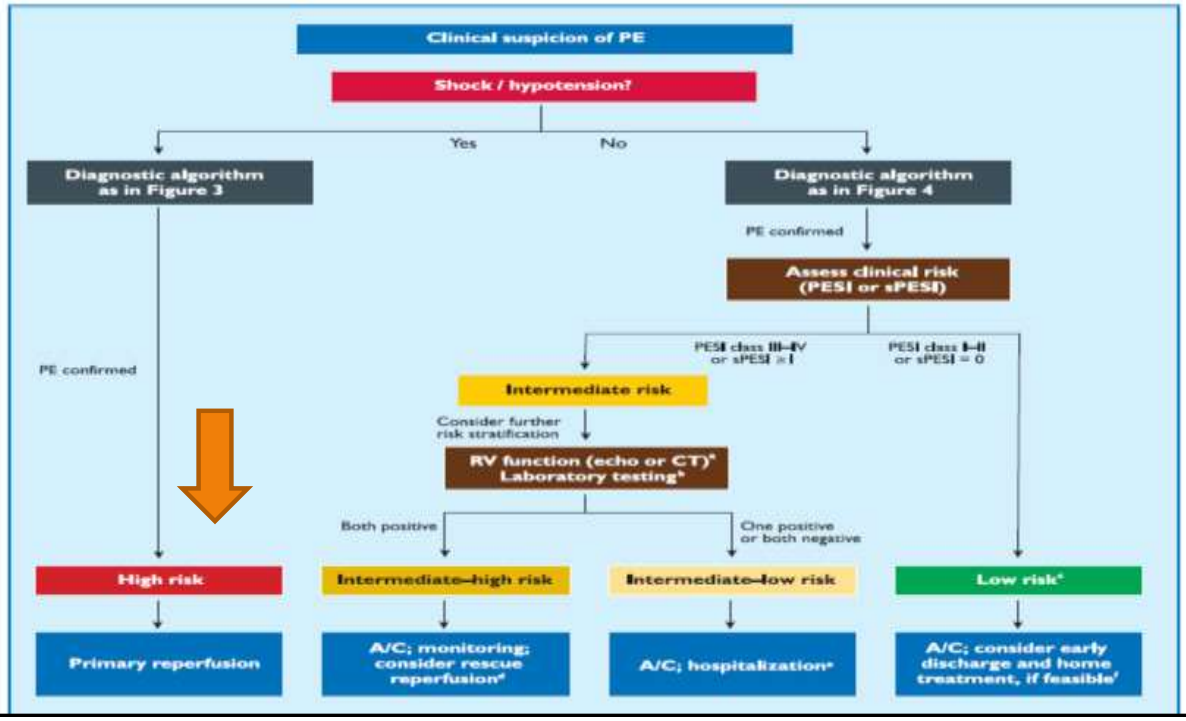
www.escardio.org/guidelines

European Heart Journal (2014):doi:10.1093/eurheartj/ehu283

Classification of patients with acute PE based on early mortality risk

Early mortality risk		Risk parameters and scores			
		Shock or hypotension	PESI class III-V or sPESI >1[a]	Signs of RV dysfunction on an imaging test[b]	Cardiac laboratory biomarkers[c]
High		+	(+)[d]	+	(+)[d]
Intermediate	Intermediate–high	-	+	Both positive	
	Intermediate–low	-	+	Either one (or none) positive[e]	
Low		-	-	Assessment optional; if assessed, both negative[e]	





Treatment

High risk PE

Vassopressor /inotropes:

-Norepinephrine and epinephreine appears to increase systemic BP.

-Levosimendan may improve RV function by combining pulmonary vasodilation with an increase in RV contractility

Ventilation:

-Oxygen

-Mechanical ventilation… low TV

… low PEEP

Thrombolysis

Best result within 24-48 hrs

Streptokinase	250 000 IU as a loading dose over 30 minutes, followed by 100 000 IU/h over 12–24 hours
	Accelerated regimen: 1.5 million IU over 2 hours
Urokinase	4400 IU/kg as a loading dose over 10 min, followed by 4400 IU/kg per hour over 12–24 hours
	Accelerated regimen: 3 million IU over 2 hours
rtPA	100 mg over 2 hours; or
	0.6 mg/kg over 15 minutes (maximum dose 50 mg)

Absolute contraindications:*
- Haemorrhagic stroke or stroke of unknown origin at any time
- Ischaemic stroke in the preceding 6 months
- Central nervous system damage or neoplasms
- Recent major trauma/surgery/head injury in the preceding 3 weeks
- Gastrointestinal bleeding within the last month
- Known bleeding risk

Relative contraindications
- Transient ischaemic attack in the preceding 6 months
- Oral anticoagulant therapy
- Pregnancy, or within one week postpartum
- Non-compressible puncture site
- Traumatic resuscitation
- Refractory hypertension (systolic blood pressure >180 mm Hg)
- Advanced liver disease
- Infective endocarditis
- Active peptic ulcer

Anticoagulation

-Unfractionated heparin infusion should be stopped during administration of streptokinase or urokinase; it can be continued during rtPA infusion.
-In patients receiving LMWH or fondaparinux at the time that thrombolysis is initiated, infusion of UFH should be delayed until 12 hours after the last LMWH injection (given twice daily), or until 24 hours after the last LMWH or fondaparinux injection(given once daily)

	Dosage	Interval
Enoxaparin	1.0 mg/kg or 1.5 mg/kg[a]	Every 12 hours Once daily[a]
Tinzaparin	175 U/kg	Once daily
Dalteparin	100 IU/kg[b] or 200 IU/kg[b]	Every 12 hours[b] Once daily[b]
Nadroparin[c]	86 IU/kg or 171 IU/kg	Every 12 hours Once daily
Fondaparinux	5 mg (body weight <50 kg); 7.5 mg (body weight 50–100 kg); 10 mg (body weight >100 kg)	Once daily

Percutaneous catheter-directed treatment

Interventional options include:-

(i) Thrombus fragmentation with pigtail or balloon catheter
(ii) Rheolytic thrombectomy with hydrodynamic catheter devices
(iii) Suction thrombectomy with aspiration catheters
(iv) Rotational thrombectomy.
(V)Ultrasound assisted catheter directed thrombolysis (ekosonic)

Surgical embolectomy

The concept of surgical embolectomy for high-risk PE, and also for selected patients with intermediate-high-risk PE, particularly if thrombolysis is contraindicated or has failed.
Surgical embolectomy has also been successfully performed in patients with right heart thrombi straddling the interatrial septum through a patent foramen ovale

Acute phase treatment

Recommendations	Class	Level
PE with shock or hypotension (high risk)		
It is recommended to initiate intravenous anticoagulation with UFH without delay in patients with high-risk PE.	I	C
Thrombolytic therapy is recommended.	I	B
Surgical pulmonary embolectomy is recommended for patients in whom thrombolysis is contraindicated or has failed.	I	C
Percutaneous catheter-directed treatment should be considered as an alternative to surgical pulmonary embolectomy for patients in whom full-dose systemic thrombolysis is contraindicated or has failed.	IIa	C

www.escardio.org/guidelines

European Heart Journal (2014):doi:10.1093/eurheartj/ehu283

Long Term management

Duration of treatment

Recommendations	Class	Level
For patients with PE secondary to a transient (reversible) risk factor, oral anticoagulation is recommended for 3 months.	I	B
For patients with unprovoked PE, oral anticoagulation is recommended for at least 3 months.	I	A
Extended oral anticoagulation should be considered for patients with a first episode of unprovoked PE and low bleeding risk .	IIa	B
Anticoagulation treatment of indefinite duration is recommended for patients with a second episode of unprovoked PE.	I	B
Rivaroxaban (20 mg once daily), dabigatran (150 mg twice daily, or 110 mg twice daily for patients >80 years of age or those under concomitant verapamil treatment) or apixaban (2.5 mg twice daily) should be considered as an alternative to VKA (except for patients with severe renal impairment) if extended anticoagulation treatment is necessary.	IIa	B
In patients who receive extended anticoagulation, the risk-benefit ratio of continuing such treatment should be reassessed at regular intervals.	I	C
In patients who refuse to take or are unable to tolerate any form of oral anticoagulants, aspirin may be considered for extended secondary VTE prophylaxis.	IIb	B

www.escardio.org/guidelines

European Heart Journal (2014);doi:10.1093/eurheartj/ehu283

THANK YOU