

Emergency Department Clinical Guidelines

ED/CCT Acute PE Guidelines

Clinical Context and Purpose

The purpose of this guideline is to provide risk stratification and interdisciplinary treatment guidelines for acute pulmonary embolism diagnosed in the ED/CCT.

Background

Acute pulmonary embolism (PE) is a commonly encountered clinical presentation in the emergency department and acute care setting with as many as 900,000 annual cases. Management of acute PE begins with appropriate risk stratification into high risk/massive PE, high risk-intermediate/sub-massive PE, low risk-intermediate/sub-massive PE, and low risk/non-massive PE. The goal of risk stratification is to identify subsets of patients who may benefit from specific treatment modalities and subspecialty care in addition to anticoagulation.

While acute PE can present in a variety of ways, risk stratification incorporates several different features of the patient's presentation including presenting symptoms and signs, hemodynamic status and vital signs, oxygen requirements, imaging evidence of clot burden and right heart strain/dysfunction, cardiac biomarker evidence of myocardial injury, presence or absence of proximal deep venous thrombosis (DVT), prognostication utilizing the Pulmonary Embolism Severity Index (PESI) and/or the simplified PESI (sPESI), as well as markers of end organ dysfunction/hypoperfusion and physiological stress, e.g. lactate elevation (see below for the PESI and sPESI scores, ECHO assessment of right heart dysfunction, and summarized in Acute PE Risk Stratification).

There are various treatment options available to patients presenting with acute PE, including parenteral anticoagulants, oral anticoagulants, systemic thrombolysis at full or reduced dose, catheter-directed thrombolysis, and catheter-directed thrombectomy (modalities which are available at Kings County Hospital Center). In rare instances patients may require surgical embolectomy and/or mechanical circulatory support (requiring transfer to appropriate facilities). Choosing between the different modalities involves risk stratification and weighing the risks and benefits on an individual case by case basis while allowing for shared decision making; consultation with Critical Care and Interventional Radiology can facilitate an interdisciplinary approach to meet individual patient needs in challenging cases (see below summarized in Acute PE Clot Management). Thrombolysis should only be considered in confirmed or highly suspected acute PE patients with significant cardiorespiratory compromise where the risk/benefit ratio is judged to be favorable. In cases when several treatment options are reasonable to offer, ideally a consensus between ED/CCT and ICU should be reached prior to thrombolysis when time allows and based on patient stability.

In addition to thrombus management, patients with acute PE may present with acute right heart failure/dysfunction and circulatory shock; management in these

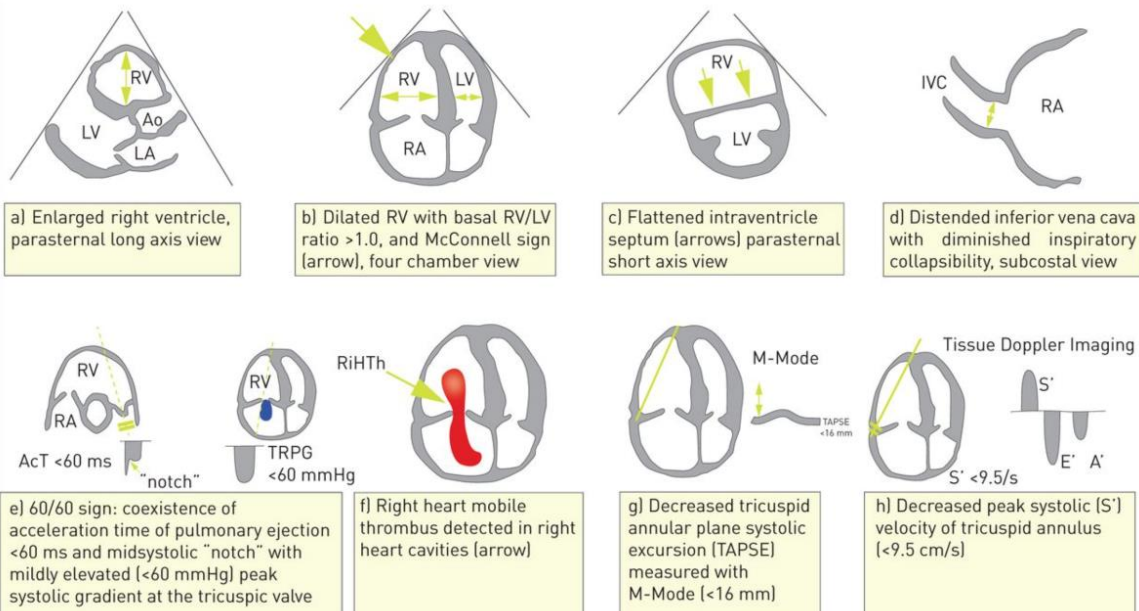
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patients should focus on stabilizing the circulation and right heart function. This may include but is not limited to titrating oxygen supplementation, judicious use of intravenous fluids and vasoactive medications, utilizing bedside ECHO to guide management (see below for suggested considerations in hemodynamic management of acute high risk PE with right heart failure/dysfunction).

PESI and sPESI Scores:

Parameter	Original version ²¹⁴	Simplified version ²¹⁸
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 blood pressure <100 mm Hg	+30 points	1 point
Respiratory rate >30 breaths per minute	+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%) 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%)		0 points = 30-day mortality risk 1.0% (95% CI 0.0%–2.1%) ≥ 1 point(s) = 30-day mortality risk 10.9% (95% CI 8.5%–13.2%)

ECHO Assessment of Right Heart Function:



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Suggested considerations in hemodynamic management of acute high risk PE with right heart failure/dysfunction (Follow institutional protocols for titratable vasoactive medication dosing ranges):

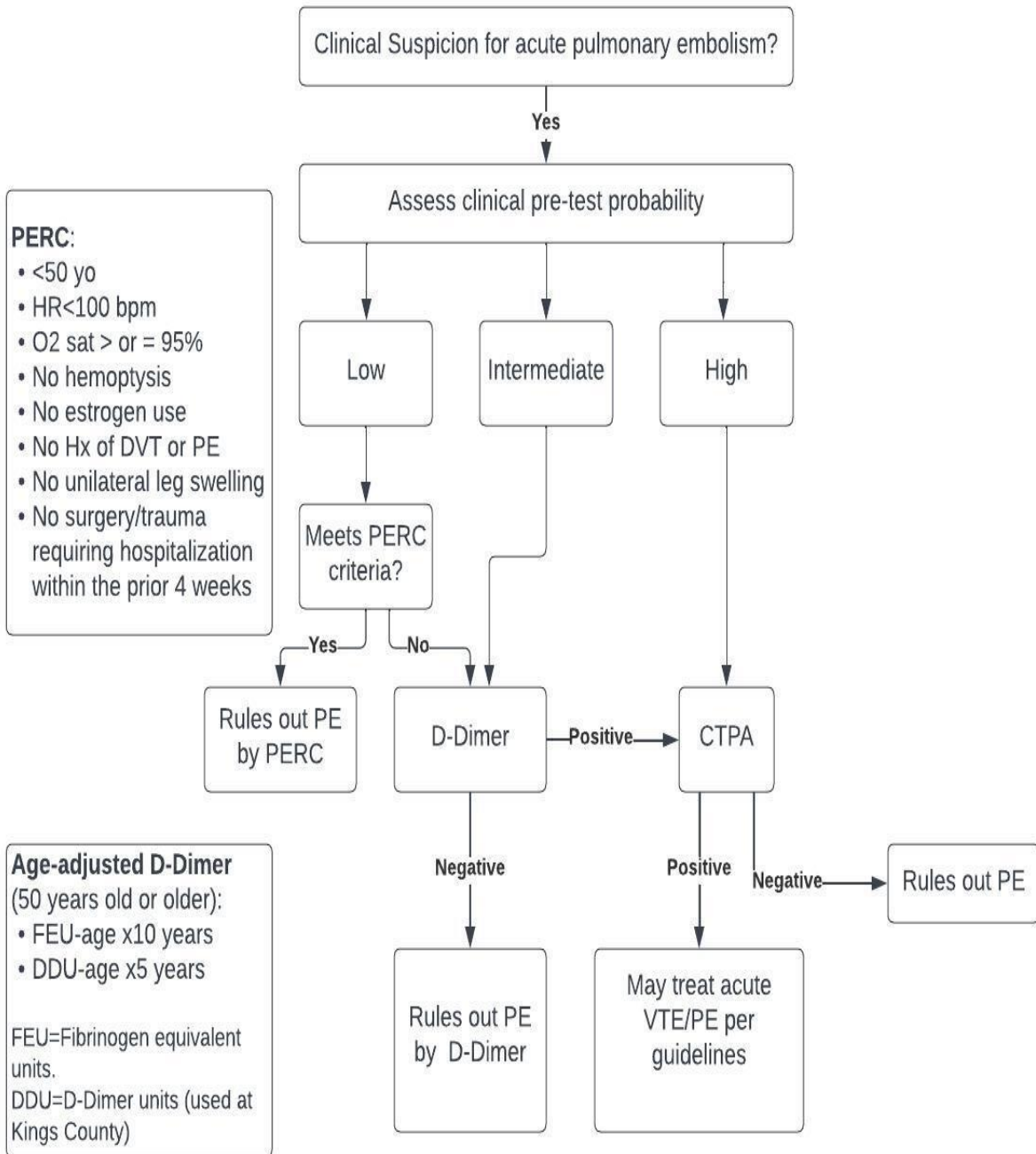
Goals	Treatment	Comments
Preload optimization	Judicious volume expansion with crystalloid	<ul style="list-style-type: none"> • Avoid volume overload • If CVP available and increased, do not give fluids; consider diuretics
Maintain systemic pressure and coronary perfusion	NE 1–40 µg/min is first line	Add vasopressin 0.04 U/min when NE dose >15 µg/min
Augment cardiac output	Dobutamine 2–10 µg/kg/min is first line	<ul style="list-style-type: none"> • Add dobutamine only after NE has already been started • Avoid milrinone because of vasodilatory effects • Epinephrine 1–10 µg/min is second line

Table 2
Intubation and mechanical ventilation of patients with acute pulmonary embolism

Goals	Treatment
Avoid intubation if possible	<ul style="list-style-type: none"> • Treat the underlying cause (PE) first • Respiratory failure should be considered an indication for systemic thrombolytics or other advanced PE treatment • Beware that intubation may precipitate cardiovascular collapse
Cardiostable induction medications	<ul style="list-style-type: none"> • Use medications with minimal vasodilatory properties • Consider etomidate or ketamine
Maintain systemic blood pressure	<ul style="list-style-type: none"> • Consider starting norepinephrine before induction • Push-dose phenylephrine is useful
Maintain normoxia and normocarbida	<ul style="list-style-type: none"> • Hypoxia and hypercapnia lead to an increase in PVR • Attention to preinduction optimization • Minimize apneic period (experienced provider intubates, consider use of video laryngoscopy) • Once intubated, adjust ventilator settings to achieve goals
Optimize tidal volumes	<ul style="list-style-type: none"> • Tidal volumes too low or too high lead to an increase in PVR • 6–8 mL/kg IBW is a good starting point

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Acute PE Guideline



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Acute PE Risk Stratification

Risk Stratification-

- Risk stratification should be used to determine optimal therapy
- Should incorporate a composite of clinical appearance, vital signs and hemodynamic stability, oxygen requirement, consideration of PESI (Pulmonary Embolism Severity index) or sPESI score, imaging evidence of RV dysfunction (ECHO, CTPA, etc) and/or cardiac biomarkers (Troponin, Pro BNP)

Massive PE

- SBP <90 for > 15 minutes
- Drop in >40 mmHg from baseline SBP
- Requiring vasopressors
- May have profound bradycardia
- Peri-arrest/Cardiac arrest
- Clot in transit

Sub-massive PE

- Positive PESI/sPESI score
- RV Dilation/dysfunction
- May have right heart strain on ECG, ECHO, and/or positive cardiac biomarkers
- Hemodynamically stable

Non-massive PE

- No right heart strain
- No elevation of cardiac biomarkers

Further Risk Stratification-

- The goal of subdividing Sub-massive PE patients into higher and lower risk groups is to identify subsets that may benefit from more aggressive therapies

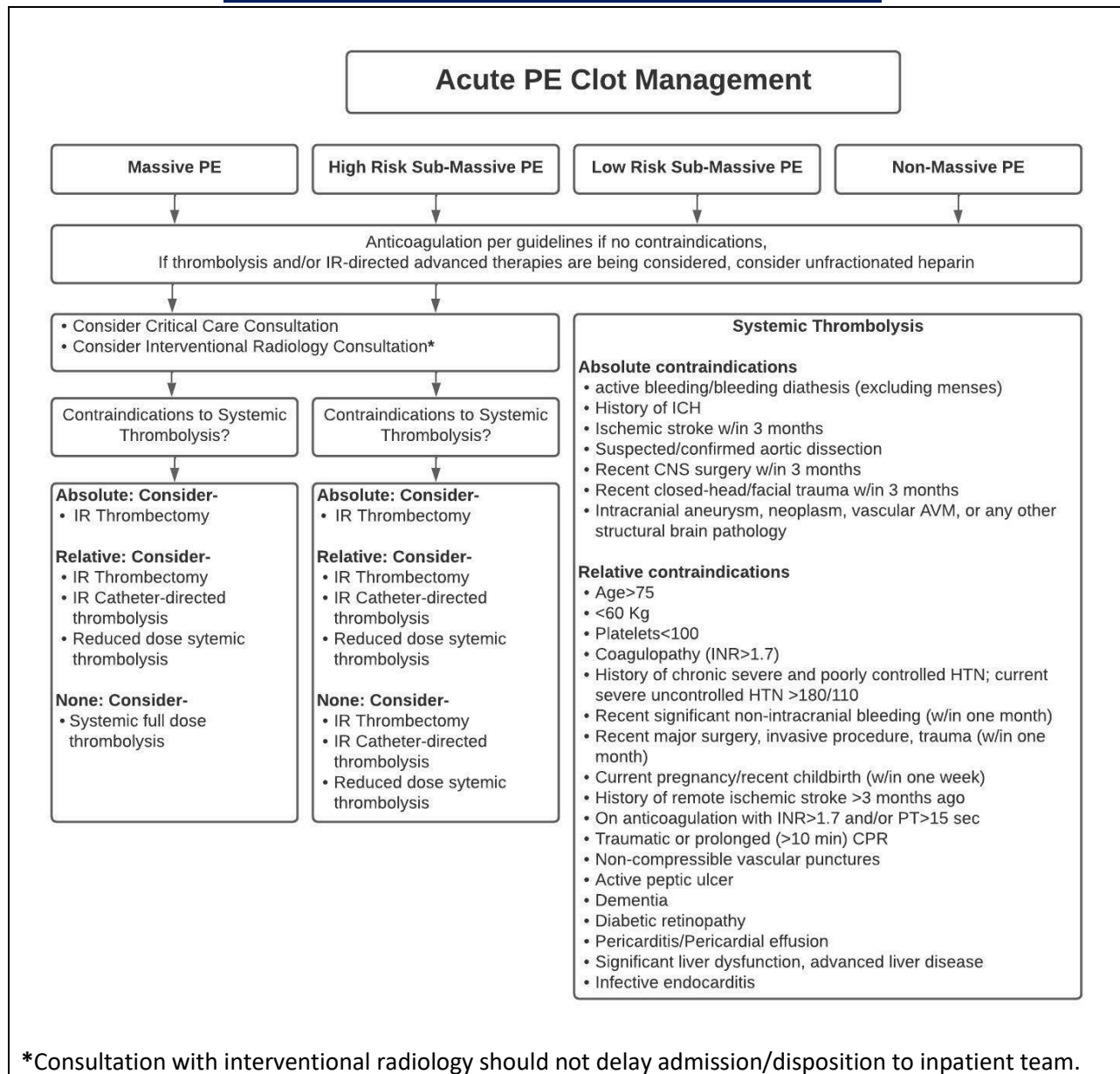
High Risk Sub-massive PE

- Evidence of RV dysfunction AND elevation of cardiac biomarkers AND one of the following:
- Increasing oxygen requirements
- Hemodynamic instability not meeting massive PE criteria
- Shock index >1.0
- Clinical deterioration and/or Patient in extremis

Low Risk Sub-massive PE

- Evidence of RV dysfunction OR elevation of cardiac biomarkers

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Resources/References

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