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Short Communication

Basics of Management of Acute Pulmonary Embolism for the Acute Physician

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Abstract

Acute pulmonary embolism (PE) is a blood clot in the pulmonary artery which can lead to increase in morbidity and mortality, management of PE is not always straight forward and can be challenging. Authors will discuss in this review the diagnosis and risk stratification of PE, the optimal management of PE, and adequate follow up plan.

Asymptomatic PE is often an incidental finding in 5% of thoracic CT scans performed for another indication and underlying malignancy was the culprit in most of these cases.

Keywords: Pulmonary embolism; CTPA; Wells score; PESI score; Thrombolysis.

Abbreviations: DVT: Deep Venous Thrombosis; LMWH: Low Molecular Weight Heparin; DOAC: Direct Oral Anticoagulants.

Introduction

Asymptomatic PE is often an incidental finding in 5% of thoracic CT scans performed for another indication and underlying malignancy was the culprit in most of these cases [1]. Most of these incidental PEs are lobar or segmental requiring anticoagulation, even incidental asymptomatic and isolated subsegmental PE without evidence of deep venous thrombosis (DVT) should be treated at least for three months as it carries the same risk of mortality and similar recurrence rates as proximal or symptomatic PE [2].

Once PE is diagnosed, the next task for the acute physician is to classify PE according to severity, classification will aid the doctor to manage PE adequately from discharge with anticoagulation to admission in critical care unit for thrombolysis. Massive PE or high-risk PE is identified when there is a shock for more than 15 minutes with systolic hypertension of 90 mm Hg or below, while sub massive or intermediate risk PE is identified when there is evidence of myocardial necrosis (raised levels of sensitive troponin) and/or evidence of right ventricular failure (CTPA/Echocardiography or raised B-

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type natriuretic peptide), presence of both is high intermediate risk versus low intermediate risk if either is present.

Discussion

Asymptomatic PE is often an incidental finding in 5% of thoracic CT scans performed for another indication and underlying malignancy was the culprit in most of these cases [1]. Most of these incidental PEs are lobar or segmental requiring anticoagulation, even incidental asymptomatic and isolated subsegmental PE without evidence of deep venous thrombosis (DVT) should be treated at least for three months as it carries the same risk of mortality and similar recurrence rates as proximal or symptomatic PE [2].

Symptomatic PE on the other hand can present with pleuritic chest pain or haemoptysis with mild shortness of breath if small and peripheral or syncope and shock if large and central, the initial approach for diagnosis depends on the clinical probability based on the two-categories scheme Wells score (Table 1) with PE unlikely if score is 0-4 points or PE is likely with score of more than 4, patients in the likely PE category should have CTPA within 24 hours and urgent anticoagulation unless CTPA can be done within 4 hours or high risk of bleed, while patients in the unlikely PE group will require a D-dimer test and if this is positive, patients can be managed the same as the likely PE group [3].

Variable	**Points**
History of:	
DVT or PE	+1.5
Surgery or immobilisation for fracture in the past month	+1.5
cancer that is active or in remission for less than six months	+1
Symptoms and clinical signs:	
Sign of DVT	+3
Haemoptysis	+1
HR>100 Beats per minute	+1.5
Alternative Diagnosis: less probable than PE	+3
Clinical probability of PE:	
Three categories	
"Low" if score<2	
"Moderate" if score between 2 and 6	
"High" if score ≥ 7	
Two categories	
"Improbable" if score ≤ 4	
"Probable" if score ≥ 5	

Table 1: The initial approach for diagnosis depends on the clinical probability based on the two-categories scheme Wells score.

Once PE is diagnosed, the next task for the acute physician is to classify PE according to severity, classification will aid the doctor to manage PE adequately from discharge with anticoagulation to admission in critical care unit for thrombolysis. Massive PE or high-risk PE is identified when there is a shock for more than 15 minutes with systolic hypertension of 90 mm Hg or below, while sub massive or intermediate risk PE is

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identified when there is evidence of myocardial necrosis (raised levels of sensitive troponin) and/or evidence of right ventricular failure (CTPA/Echocardiography or raised B-type natriuretic peptide), presence of both is high intermediate risk versus low intermediate risk if either is present. Absence of any of the previous features is classified as low-risk PE [4]. Thrombolysis is the first line treatment for patients presenting with massive PE, alteplase is the most common used recombinant tissue plasminogen activator with a recommended dose of 10 mg loading over 2 minutes and followed by 90 mg infusion over 2 hours, in patients under 65 Kg a total dose of 1.5 mg/Kg is recommended (10 mg loading then the rest over 2 hours) and in cardiac arrest or peri-arrest situations a 50 mg bolus is recommended [5]. Following thrombolysis by 2 hours its recommended to start heparin infusion if the APTT is less than twice the upper limit of normal and convert to low molecular weight heparin (LMWH) after 24 hours, if LMWH was given prior to thrombolysis authors recommend heparin infusion as above but after 18 hours from the initial LMWH dose if once a day dose given or after 8 hours at least if twice a day dose of LMWH was given [6]. Sub massive or intermediate risk PE management is challenging, thrombolysis of a normotensive patients with PE can increase mortality [7]. Thrombolysis showed an increased risk of major bleeding to 9.1% and intracranial haemorrhage by 0.5% in a large meta-analysis and a large RCT reported an increase in major bleeding by 6.3% and intracranial haemorrhage by 2% [8]. The real challenge for the acute physician when facing a case of a normotensive sub massive PE is to thrombolysis or not, usually these patients are on high oxygen requirements, tachycardiac and risk of deterioration, this is a scenario where a multidisciplinary approach is highly recommended with a risk stratification approach. Severity scoring systems like PE Severity Index (PESI) (table 2) can identify poor outcomes and presence of signs of right ventricular dysfunction and ischemia as well as the presence of DVT can all aid the decision of thrombolysis in a case of sub massive PE [9-11].

Variable	Original PESI* Score	Simplified PESI+ Score
Age>80 Years	Age in Years	1
Male Sex	+10	-
History of cancer	+30	1
History of heart failure	+10	1‡
History of chronic lung disease	+10	
Pulse ≥ 110 beats/minute	+20	1
Systolic blood pressure<100mm HG	+30	1
Respiratory rate ≥ 30 breaths/minute	+20	-
Temperature<36°C	+20	-
Altered mental status§	+60	-
Arterial oxygen saturation<90%#	+20	1

Table 2: *A total point score for a given patient's is obtained by summing the patient's age in years and the points for each applicable prognostic variable. The five following risk classes are defined based on patient's total point score: class I (≤ 65 points), class II (66-85 points), class III (86-105), class IV (106-125 points), and

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class V (>125 points). Patients in risk classes I/II are considered low risk. †A total point score for a given patient is obtained by summing the points for each applicable prognostic variable. Patients with 0 points are considered low risk. ‡The variable was combined into a single category of chronic cardiopulmonary disease. §Altered mental status was defined as disorientation, lethargy, stupor, or coma. #Arterial oxygen saturation was defined with and without the administration of supplement oxygen.

Half dose alteplase when used for patients with sub massive PE has shown superior efficacy than anticoagulation without an increase in bleeding risk and in a different RCT half dose alteplase has shown equal efficacy with less bleeding when compared to anticoagulation [12,13].

Up to 40% of patients present to the acute physician in ambulatory care unit with a low-risk PE, these patients may benefit from early discharge and can be managed safely on outpatient bases. Patients with a very low or low PESI score are candidates for early discharge on Direct oral anticoagulants (DOAC) and follow up in ambulatory care clinics [14-16].

Authors have briefly discussed the diagnosis and management of PE and would like to emphasise adequate follow-up for these patients. It is fair to say that the acute physician who initiated treatment for PE is the main responsible physician to arrange an adequate follow up ensuring compliance with treatment, absence of side effects from treatment, presence, or absence of complications of PE and equally importance the requirement for cancer screening. The rate of cancer detection in a newly diagnosed unprovoked VTE is approximately 5% in the first year [17].

NICE recommends a review for patients with PE seven days and three months post diagnosis, the early review is for symptoms enquiry, presence of side effects from anticoagulation use and cancer risk assessment, recommendations for cancer assessment for patients with unprovoked thrombus (PE or DVT) are physical examination, chest X-ray (although CTPA is sufficient), blood tests including full blood count, liver function, and calcium level, and CT abdomen and pelvis and a mammogram in females who are over 40 who presents with unprovoked thrombus [18].

Three months review is mainly indicated for symptoms enquiry and consideration of echocardiography if shortness of breath persists, and decision regarding duration of anticoagulation which is usually 3-6 months for provoked PE or lifelong for unprovoked PE, Lower dose of DOAC is used after the duration of treatment is accomplished in patients with unprovoked or recurrent PE [19,20].

Conclusion and learning points

1. Isolated subsegmental PE has same risk as symptomatic or proximal PE
2. Half dose thrombolysis has shown safety and efficacy in normotensive sub-massive PE
3. PESI score is a well validated tool for prognostication of PE
4. Follow up is an essential part of managing patients with PE, early review for anticoagulation side effects and cancer screening while late review is for symptoms enquiry and requirement of echocardiography and assessment for the duration and need of lifelong anticoagulation.

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