TWO ELDERLY PATIENTS WITH DYSPNOEA: DIAGNOSIS AND MANAGEMENT

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Summary
Dyspnoea is a common reason of hospital admission in elderly people. We report two elderly patients who presented with dyspnoea due to acute massive pulmonary embolism. Early diagnosis could not be made in the first patient so that specific treatment could not be given to him. He deteriorated and succumbed soon after admission. The second patient, an old lady, had rather unstable vital signs on presentation. Acute pulmonary embolism was suspected early and confirmed soon after admission. Intravenous thrombolytic therapy was given. She had a good recovery and was subsequently discharged home. High degree of suspicion is required so that early and correct diagnosis of acute pulmonary embolism can be made and specific treatment given to improve the outcome of these patients.

Case Report
Case 1
Mr C.T. was a 79-year-old gentleman with good past health. He presented to the accident and emergency department of our hospital because of dyspnoea and dizziness for few days. He also had one episode of syncopal attack. There was no preceding aura associated with the syncope. He did not have any chest pain. On examination in the accident and emergency department, he was found to be tachypnoeic but not cyanotic. His blood pressure and pulse were 140/70 mm Hg and 145/min respectively. Examination of the chest revealed fine basal crepitations. Otherwise, examination of the cardiovascular and neurological systems were unremarkable. His chest X-ray showed cardiomegaly. ECG revealed sinus tachycardia with Q wave in inferior leads and T wave inversion in lead V1 to V3. Arterial blood gas showed type I respiratory failure with hyperventilation (pH=7.48, pO2=56 mmHg, pCO2=30 mmHg). Renal function was impaired (urea = 10.4 mmol/L, Creatinine = 194 (µmol/L)).

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Initial diagnosis made was congestive heart failure with mild renal impairment. He was treated with oxygen and diuretic therapy. However he did not improve and deteriorated, there is persistent hypoxaemia despite oxygen therapy and blood pressure remains on low side despite inotropes. He had cardiopulmonary arrest 5 hours later with failure of resuscitation. Postmortem examination revealed extensive pulmonary embolism in the left and right main branches of pulmonary artery. No
deep vein thrombosis was identified.

Case 2

Mrs KY was an 82-year-old lady with good past health but with poor mobility due to osteoarthritis of both knee joints. She presented to accident and emergency department of our hospital because of acute onset of dyspnoea and dizziness. She did not have any chest pain. She was found to be tachypnoeic but not cyanotic. Her blood pressure was 93/59 mmHg with a pulse rate of 100/min. She was afebrile and there was no evidence of sepsis or bleeding. Examination of the respiratory system and neurological systems were unremarkable. Chest X-ray is unremarkable.

Her SaO₂ on pulse oximetry was 92% while being put on 100% oxygen. Her ECG showed S₁Q₃T₃ features (Figure 1). Urgent transthoracic echocardiogram revealed normal left heart but with dilated right atrium and right ventricle. There was no evidence of sepal defect or left- sided valvular lesion. In view of the unstable vital sign and strong clinical suspicion of acute pulmonary embolism, an emergency spiral CT scan of the thorax was performed. The scan confirmed the presence of thrombi in right main pulmonary artery and in the segmental branches of both upper lobes, right middle lobe, and both lower lobes. Baseline clotting profiles were normal and subsequent doppler ultrasound of lower limb did not reveal any evidence of deep vein thrombosis.

![Figure 1. ECG of case 2 showing classical S₁Q₃T₃ patterns.](image)

Weight adjusted dosage of thrombolytic therapy with recombinant tissue plasminogen activator, 50mg was initiated for the patient immediately after the spiral CT scan. Four hours after the thrombolytic therapy, her SaO₂ improved to 100% while on 50% oxygen supplement. Her blood pressure also improved to 130/85mm Hg with a pulse rate of 75/min. There was no bleeding complication. She remained well and was subsequently discharged home. She was put on long term warfarin therapy because of her poor mobility and she has regular follow up in our clinic.

Discussion

Acute pulmonary embolism is a potentially fatal disease if not promptly diagnosed and managed properly. Kasper et al¹ reported in a multicentre registry of acute major pulmonary embolism involving a total of 1001 patients, the overall inhospital mortality was 22%. There was a substantial increase in mortality rate from 8.1% in patients with hemodynamic stability at presentation to 65% in patients requiring cardiopulmonary resuscitation. In most cases, death is related to the thromboembolism event. However high degree of clinical suspicion is required for the diagnosis. In a study of 92 patients with fatal pulmonary embolism, the diagnosis was not made before post-mortem in 51%².

Diagnostic features of pulmonary embolism

Studies have demonstrated that asymptomatic pulmonary embolism of variable magnitude occurs in 40-60%³. Goldhaber and Braunwald⁴ had classified pulmonary embolism into different clinical syndromes, based on the severity and time course. These syndromes include massive pulmonary embolism, submassive pulmonary embolism, and pulmonary infarction.

Massive pulmonary embolism is defined as severe obstruction of pulmonary artery flow causing an increase in right ventricular afterload and consequent elevation of pulmonary artery pressure. Such patients have the highest risk of sudden death and over the long term, chronic pulmonary hypertension if the arterial clot fails to lyse. The most common features which suggest this diagnosis are syncope, cardiogenic shock or cardiac arrest with electromechanical dissociation. There is often preceding dyspnoea or pleuritic chest pain. Syncope can be due to cardiogenic shock or infrequently, associated vagal bradycardia. Patients usually have tachycardia and tachypnoea with hypotension.

In the first patient, his tachypnoea and tachycardia should alert the physician to include pulmonary embolism in the differential diagnoses. His syncope did point to the severity of the pulmonary embolism. It might be reasonable to treat him as having congestive heart failure initially, but pulmonary embolism should be suspected when
the patient did not respond to anti-heart failure treatment. In our second patient, her cardiogenic shock indicated the severity of her pulmonary embolism.

Submassive pulmonary embolism is defined as embolism to one or more pulmonary segments, not associated with elevation in rightventricular or pulmonary artery pressure. The most frequent symptoms being dyspnoea and pleuritic chest pain. These patients are not likely to succumb to an acute episode. However unlysed thrombus in the pulmonary arteries could eventually lead to chronic pulmonary hypertension.

Pulmonary infarction can occur if bronchial blood flow collateral is not preserved after occlusion of pulmonary arteries, symptoms and signs usually develop 3 to 7 days after the onset of embolism. The majority of patients have intense pleuritic chest pain and some present with hemoptysis.

In summary, pleuritic chest pain and dyspnoea are common presenting symptoms of pulmonary embolism . Patients having massive pulmonary embolism usually have hypotension and tachycardia as well.

**Investigations**

**i) Electrocardiography**

ECG abnormalities in pulmonary embolism are common but not specific. Changes include sinus tachycardia and non-specific changes in the ST segment and T wave. Features of right heart strain such as S1Q3T3, right bundle branch block and right axis derivation can occur in massive pulmonary embolism but only in 26% of patients evaluated in the Urokinase pulmonary embolism trial. Our first patient, he had sinus tachycardia. There was also T wave inversion in leads V1 to V3 which might imply right heart strain. Our second patient’s ECG showed typical S1Q3T3 pattern and was shown in appendix 2.

**ii) Arterial Blood Gas**

The arterial blood gas is characterized by ventilation perfusion mismatch and hyperventilation with reduced P O2 and normal or low P CO2. These features although present in the first patient are not specific for pulmonary embolism.

**iii) Echocardiogram**

In patient with major pulmonary embolism, echocardiographic changes include right heart dilatation, right ventricular hypokinesia, tricuspid regurgitation and pulmonary artery enlargement. Thrombus in the main pulmonary trunk or proximal right / left pulmonary artery sometimes can be visualized by transthoracic echocardiogram, or more readily by tranoesophageal echocardiogram. Other differential diagnoses like myocardial infarction, aortic dissection, cardiac tamponade can be made by echocardiogram. Moreover echocardiographic right heart assessment has a bearing on the choice of treatment as described later in this article. Echocardiogram, if performed for the first patient, may give us some clues to the diagnosis and unfortunately it was not performed.

**iv) Ventilation Perfusion Lung Scan**

The principle of ventilation perfusion scan is that perfusion defects occur in parts of the lung with preserved ventilation in pulmonary embolism. Positive perfusion scans had a positive predictive value of 95%. A negative perfusion scan had a negative predictive value of 81%. Combining clinical assessment with the perfusion scan showed good results when clinical assessment and perfusion scan reading are concordant. When clinical and perfusion scan assessments are discordant, other investigations like pulmonary angiography are required.

**v) Spiral CT Scan**

Spiral CT scan detects intravascular clot from the main pulmonary trunk to segmental branches with good sensitivity and specificity. Therefore it is useful in diagnosing massive or submassive pulmonary embolism. As subsegmental pulmonary arteries are not reliably visualized, it is less accurate than angiography in minor embolism. In one study the sensitivity of spiral CT was 91% and the specificity was 78%. The positive predictive value was 100% and the negative predictive 89%.

We relied on this non-invasive method for confirming the diagnosis of acute massive pulmonary embolism in our second patient. The choice of this imaging modality rather than ventilation-perfusion lung scan was because of availability of spiral CT scan in our hospital on an emergency basis. Spiral CT scan is less invasive and therefore less risky as compared to pulmonary angiography especially in unstable patient.

**vi) Pulmonary Angiography**

Pulmonary angiography is considered to be the gold standard of investigation of pulmonary embolism. Because of its invasive nature and the availability of other sensitive and specific non-invasive methods described above, it is not usually necessary.
vii) Others

Other tests include those looking into the etiology of thromboembolism like clotting parameters, doppler ultrasound to look for deep vein thrombosis.

Treatment

i) General Supportive Measure

Analgesia should be given to patients with severe pleuritic pain. Hypoxaemia should be treated with high concentration of oxygen. Hypotensive patients should receive fluid replacement with central venous pressure monitoring.

ii) Thrombolytic Therapy

Thrombolytic therapy is indicated for patients with acute pulmonary embolism who are hypotensive and with arterial hypoxia. For those patients who are clinically stable but with echocardiographic evidence of right heart failure, thrombolytic therapy is also beneficial. It could directly lyse the clot inside the pulmonary tree with prompt improvement of hemodynamics in massive and submassive pulmonary embolism. This is in contrast to anticoagulation, which could only prevent further clot propagation while allowing the clot inside the pulmonary tree to lyse by natural fibrinolytic mechanism. In a study with 1001 patients with pulmonary embolism, 30 day mortality after primary thrombolysis was 3.0% compare with heparin group of 9.2%. Difference in mortality between the two treatment groups was especially prominent in patients with arterial hypotension (4.4% vs 14.9%), syncope (4.4% vs 17.9%), and echocardiographic evidence of right ventricular enlargement (4.7% vs 11.1%). The prompt improvement of the hemodynamic status of our second patient did illustrate the effectiveness of thrombolytic therapy.

The Food and Drug Association (FDA) approved regimens of thrombolytic therapy for acute massive pulmonary embolism which include streptokinase, rtPA and urokinase. Streptokinase is given as 0.25 mega unit over 30 minutes, then 0.1 mega unit/hour for 24 hours, while rtPA is given as 100mg intravenous infusion over 2 hours. The main complication of thrombolytic therapy is bleeding, most of which are mild. We have in our hospital a standardized protocol of use of thrombolytic therapy in patients with acute massive pulmonary embolism and part of which is included in appendix 1.

iii) Anticoagulation

Anticoagulation has been shown to reduce the incidence of fatal recurrent pulmonary embolism. Heparin should be continued until adequate maintenance anticoagulation with warfarin is achieved. Heparin may be discontinued if the INR is in the therapeutic range (2.0-3.0). Study has indicated that low molecular weight heparin may be as effective as unfractionated heparin in non-life threatening pulmonary embolism. The mechanism of this therapy is to prevent further clot propagation while allowing the clot inside the pulmonary tree to lyse by natural fibrinolytic mechanism. Therefore, anticoagulation alone is not adequate in acute massive pulmonary embolism.

iv) Catheter-based therapy

Catheter tip devices for extraction and fragmentation of pulmonary thromboemboli offer a therapeutic option to patients with massive pulmonary embolism who have contraindications to thrombolytic therapy or failed thrombolytic therapy. The mechanism involves fragmentation of the blood clot by the ultrasound delivered in the catheter tip while having simultaneous suctioning of the blood clot from the pulmonary tree.

v) Pulmonary Embolectomy

Open surgical removal of the pulmonary emboli may have life-saving potential in those patients with hemodynamic instability who are contraindicated for thrombolytic therapy or failed thrombolytic therapy. With the availability of thrombolytic therapy and transcatheter technique of embolectomy, this option is of rarer use.

Summary

Acute pulmonary embolism is a potentially fatal disease. Our first patient succumbed a few hours after admission. Our second patient had more obvious ECG features of right heart strain which hinted us to utilize other imagining modalities to confirm the diagnosis. Subsequent thrombolytic therapy helped to lyse the clot and stabilize the patient. High degree of suspicion is required for making an early and correct diagnosis so that specific treatment such as thrombolytic therapy can be given promptly to improve the outcome of these patients.
References

APPENDIX I
Guideline on Thrombolytic Therapy for Patients with Acute Massive Pulmonary Embolism

Introduction
For patients presented with acute massive pulmonary embolism (documented by spiral CT of thorax, pulmonary angiogram, ventilation-perfusion lung scan or echocardiography), thrombolytic agent can be considered as an effective treatment modality apart from traditional anticoagulation or surgery. It is particularly useful for unstable patients with hemodynamic collapse, significant hypoxemia or evidence of acute right ventricular failure.

Points to note in diagnosis of pulmonary embolism
I) Suspect pulmonary embolism in patient with
   • Sudden collapse with raised JVP
   • Pleuritis + haemoptysis
   • Unexplained acute dyspnoea and hypoxia with normal chest radiograph
II) Pulmonary embolism unlikely if
   • Not tachypnoeic (RR < 20/min) &
   • No pleuritic pain &
   • No arterial hypoxaemia
III) Intermediate or low probability V/Q scans do not completely exclude pulmonary embolism
IV) Major risk factors for pulmonary embolism (PE)
   • Recent major surgery / immobilisation
   • Recent lower limb trauma / surgery
   • Clinical deep vein thrombosis (DVT)
   • Previous proven DVT / PE
   • Pregnancy or post-partum
   • Major medical illness

Thrombolytic agents available
I) Streptokinase (SK)
II) Recombinant Tissue Plasminogen Activator (rtPA)
III) Urokinase (UK)

All these agents are approved by FDA for treating pulmonary embolism

Inclusion criteria
Patients with documented acute (onset within 2 weeks) massive pulmonary embolism (by spiral CT of thorax or pulmonary angiography or high probability ventilation-perfusion lung scan or echocardiography) and at least one of the following features (or at the discretion of supervising
physician if patient has high clinical likelihood and death is imminent):

I) Systemic arterial hypotension (SBP < 90mmHg)
II) Cardiogenic shock (SBP < 90mmHg plus clinical signs of organ hypoperfusion and hypoxia)
III) Circulatory collapse necessitating cardiopulmonary resuscitation
IV) Arterial hypoxemia e.g. SaO2 < 90% while on 50% O2 mask (for patient who is strongly suspected of having pulmonary embolism, checking of arterial blood gas should be avoided in view of increased risk of arterial puncture site bleeding from thrombolytic therapy)
V) Echocardiographic evidence of dilated RV, paradoxic septal wall motion, significant tricuspid regurgitation, RV dysfunction (in the absence of LV failure, mitral valvular disease or pulmonary disease)

N.B.: For patients with the feature(s) I - V mentioned above and if emergency treatment (i.e., thrombolytic therapy or surgery) will be started after documentation, urgent spiral CT of thorax may be indicated for documentation of acute massive pulmonary embolism.

**Contraindications and cautions for thrombolytic use in acute pulmonary embolism**

**Contraindications**
- Suspected aortic dissection
- Suspected acute pericarditis
- Previous hemorrhagic stroke at any time, other strokes or cerebrovascular events within 1 year
- Known intracranial neoplasm
- Active internal bleeding
- Known bleeding diathesis
- Pregnancy

**Cautions / relative contraindications**
- Severe uncontrolled hypertension on presentation (BP > 180/110 mmHg) which does not settle with pain relief or drug treatment (risk of intracerebral hemorrhage)
- Current anticoagulant therapy (INR > 2.0)
- Recent trauma (within 2 - 4 weeks)
- Surgery (esp. spinal or CNS), organ biopsy, cavity aspiration or puncture of a non-compressible vessel (within 2 - 4 weeks)
- Recent internal bleeding (within 1 - 2 months) e.g. GIB
- Active peptic ulcer
- Prolonged CPR (> 5 - 10 min) esp. if intubation has been done
- Severe proliferative diabetic retinopathy.
- Severe hepatic or renal dysfunction
- Severe underlying disease with poor prognosis or poor quality of life
- Recent abortion or delivery (within 2-4 weeks)
- Menstruating female
- Diagnosed infective endocarditis
- Active pancreatitis