Massive & Sub-massive Pulmonary Embolism

Current Strategies in investigation & management

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Case scenario

- A 55-year-old man arrives in A&E complaining of acute onset of difficulty breathing and a sore right leg. He has a travel history of a non-stop New York-to-Singapore flight a few days ago.

- His BP is 100/60, HR 110, RR 24, SpO2 92%. Physical exam is unremarkable except for right sided chest pain on deep inspiration, and a tender, swollen right calf.
How do we investigate & manage our 55-year-old patient?

- What is “massive” & “sub-massive” PE?
- What are the current diagnostic strategies?
- What are the current management strategies?
Why is it important to know about PE?

- USA: affects 600,000/yr & kills 50,000 to 200,000/yr. *(Arcasoy M. Chest 1999)*
- 10 to 20% of all in-hospital deaths.
- ? Less in Asians
- A local autopsy series found that 74% of fatal PE were unsuspected. *(Lau G. Ann Acad Med Singapore 1995)*
- True incidence unknown.
Virchow’s Triad

Venous Stasis
e.g. immobility

Endothelial damage
e.g. trauma, surgery

Hypercoagulable state
e.g. cancer
What are the risk factors for PE?

- **Acquired factors**
  - immobility, obesity, age
  - Critical illness, cancer, heart failure
  - recent surgery, trauma/burns, traction/cast
  - pregnancy/post-partum, OCPs
  - Previous DVT, PE

- **Hereditary factors**
  - Prot C, S, antithrombin deficiency, Factor V Leiden, antiphospholipid antibody*
What are the differential diagnoses? chest pain & dyspnea

- Pneumonia, Bronchitis
- Asthma or COPD exacerbation
- AMI
- Pulmonary edema
- Anxiety
- Aortic dissection
- Pneumothorax
- Musculoskeletal pain
Canadian (Wells) prediction score

Variable and score

DVT symptoms and signs — 3.0
PE as likely as or more likely than alternative diagnosis — 3.0†
Heart rate >100 beats/min — 1.5
Immobilization or surgery in previous 4 wk — 1.5
Previous DVT or PE — 1.5
Hemoptysis — 1.0
Cancer — 1.0

Total score‡:

<2.0 — low pretest probability
2.0 to 6.0 — moderate pretest probability
>6.0 — high pretest probability

Dichotomized Wells score§

≤4 — PE unlikely
>4 — PE likely
What investigations would you order to diagnosis PE?

- Chest X-ray
- ECG
- Arterial Blood Gas
- D-Dimer
- Spiral CT: PE protocol
- V/Q scan
- Duplex ultrasound of lower limbs
Fig. 1 Twelve-lead electrocardiogram showing sinus tachycardia with deep S waves in lead I, inverted T waves and Q waves in lead III as well as a right ventricular strain pattern.
Should we do a D-dimer for our patient?

- D-dimer is useful to *exclude* PE where clinical probability is low


What is the role of the V/Q scan?

- A normal V/Q scan essentially rules out PE, with a negative predictive value of 97%.
- A high probability V/Q scan has a positive predictive value of 85-90%.
- However, the V/Q scan is diagnostic in only 30-50% of all patients with suspected PE.

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Are there any other investigations you want to do?
Risk stratification in PE
Sub-massive & Massive PE

- **Hemodynamically unstable (Massive PE)**
  - Shock or sustained hypotension: Systolic BP<90mmHg, Pressure drop>40mmHg for >15mins

- **Hemodynamically stable (Sub-massive PE)**
  - Right ventricular dysfunction* on Echo
    - *independent predictor of 30-day mortality
  - Troponins
Right Ventricular Dysfunction in Sub-massive PE
Investigations for submassive/massive PE

- Chest X-ray
- ECG
- Arterial Blood Gas
- D-Dimer
- Spiral CT: PE protocol
- V/Q scan
- Duplex ultrasound of lower limbs
- 2-D Echo
- Troponins
- +/- Pulmonary angiogram
Hemodynamically unstable

Proceed to thrombolysis, surgery, or catheter embolectomy

Hemodynamically stable

Evaluate clinical and cardiac features

Assess for right ventricular dysfunction
Echocardiography
Multidetector CT
Assess for right ventricular injury
Troponin

No dysfunction or injury
Continue anticoagulation and consider admission and early discharge or home treatment

Dysfunction
Continue anticoagulation
Medical ward admission

Dysfunction and injury
Consider ICU admission or thrombolysis in patients at low risk for bleeding
How would you treat PE?

- LMWH e.g. Clexane
- Warfarin
- IVC filter
- Thrombolytic therapy e.g. tPA, streptokinase
- Catheter embolectomy
- Surgical thrombolectomy
To recap

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Investigations & Management of our patient

- High clinical probability (Well’s score)
- Confirm diagnosis with CT Scan
- Echo to look for RV dysfunction; Troponins
- If present, thrombolytic therapy if no serious bleeding risks
- If hemodynamics become unstable – mechanical/surgical interventions
- Subsequent anticoagulation.
Thank you for your attention