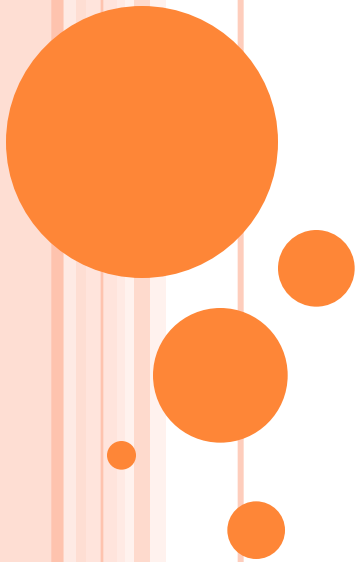




CASE PRESENTATION:

Dr. Muhammad Razaqat
Deptt. Of Medicine
FMH



Biodata

- **NAME:** Mr. Samuel.
- **AGE** : 29 Years
- **GENDER:** Male
- **ADDRESS:** Lahore
- **DOA:** 11th January 2009
- **MOA:** CED

Presenting Complaints

- Shortness of breath ----- 1 day
- Hemoptysis ----- 1 day
- Chest pain----- 1 day
- Pain in left leg----- 5 days

History Of Presenting Illness

- 29 year old NEGRO, a footballer, is in his usual state of health 5 days back when he had injury of left leg during his play
- Had some injection from local GP for leg pain, PAIN is persistent and severe associated with mild swelling
- Since morning he developed progressive SOB, sudden in onset associated with severe central chest pain which is aggravated by deep breathing and not relieved by any medication

Cont...

- Along with SOB he had 1-2 episodes of hemoptysis bright red in color and about one teaspoonful
- No previous history of SOB, CHEST PAIN AND COUGH ,SPUTUM AND FEVER

Past Medical History

- Pulmonary TB in 1999
- Non diabetic, non hypertensive
- No history of any drug abuse
- No previous hospitalization

Drug History

- No medications and known allergies

Family History

- No significant h/o of any disease or disorder in the family like:
 - DM, HTN, IHD, Asthma, Jaundice, TB, or any Blood or Bone related disorder.

Personal History

- Non smoker.
- No other forms of addictions or chronic drug intake
- Businessman

Socio Economic History

- Middle class status
- Unmarried

Examination

- A 29 year old negro of average built lying in his bed, conscious alert and well oriented to time place and person
- Vitals
 - Pulse: 130 beats/min, regular, normal volume
 - BP : 130 / 90 mmHg
 - RR : 28 breaths/ min. OXYGEN SAT 64% on room air
 - T : 98.6 F

Cont...

○ GPE

Pallor –ve, Jaundice –ve, Cyanosis –ve,
Clubbing –ve, Edema –ve

- JVP: Not raised
- Neck Veins: Not Engorged
- Thyroid Gland: Not Enlarged
- No sig group of Lymph Nodes enlarged or palpable

Systemic Examination

CVS:

coarse

S1 + S2 + 0
lower one

No added sounds

No Murmurs

GIT:

Abdomen Soft

Non tender

No HSM

BS +ve

FT -ve, SD -ve.

RESP:

Harsh vesicular breathing with

paninspiratory crackles over

third of chest (Rt > Lt).

B/L occasional bronchi

CNS:

HMF: Intact

GCS: 15/15

Planters B/L down going

Pupils B/L fixed and dilated

Power, Tone, Reflexes: Intact

Cont...

MUSCULOSKELETAL:

- LEFT LEG : Warm and swollen and tender on palpation.
- RIGHT LEG: Normal

Investigations

TLC	11000
Hb	13.9 g/dL
Platelets	159
BSR	186 mg/ dL
S.Creat	1.2
ALT	29
S/Na	140 mmol/L
S/K	3.5 mmol/L
PT	20 sec/13 sec
APTT	40 sec/ 33 sec

Cont...

- CPK : 1962.
- CK-MB: 122.
- Sputum for AFB
-Negative
- ABGS:Type1
respiratory failure
- ECG: RBBB
- Anti-HCV –
Negative
- HBsAg –Negative
- HIV–Negative
- TPHA –Negative
- D-dimers –
Positive.

Imaging

- CHEST X-RAY :
B/L hilar infiltrates.
- DOPPLER U/S LEGS:
Shows Lt superficial femoral vein, popliteal vein and posterior-tibial vein thrombosis.
- HRCT:SHOWS area of ground glass haze seen bilaterally in patchy distribution.No reticulation,honey combing or pleural effusion seen on either side.

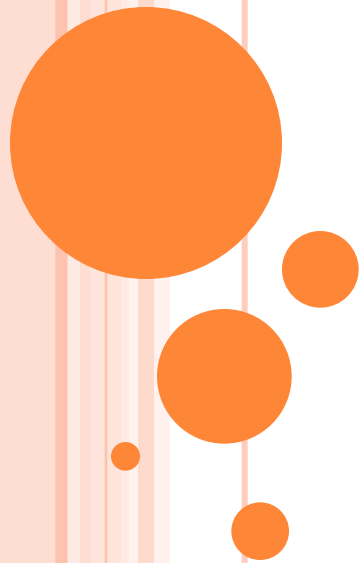
TREATMENT

- Oxygen Inhalation.
- Injection Clexane 80 mg S/c BD.
- Tablet Warfarin 5 mg 1 OD.
- Tablet Distalgesic 2 BD.



Pulmonary

Embolism



Pulmonary Embolism (PE)

Introduction

- Common and fatal disease
- Mortality can be reduced by prompt diagnosis and therapy
- Clinical presentation of PE is:
 - Variable and non specific
 - Making accurate diagnosis difficult



Pulmonary Embolism (PE)

- Definition

PE refers to obstruction of pulmonary artery or one of its branches by material (e.g. thrombus, tumor, air or fat) that originated elsewhere in the body



Classification

- Acute PE
- Chronic PE



Cont...

○ Acute PE

- Patients with acute PE typically develop symptoms and signs immediately after obstruction of pulmonary vessels

○ Chronic PE

- Patients with chronic PE tend to develop slowly progressive dyspnea over a period of years due to pulmonary hypertension



Acute PE Classification

1) Massive PE

- Causes hypotension, defined as a systolic blood pressure $< 90\text{mm Hg}$

OR

- A drop in systolic blood pressure of more than or equal to 40mm Hg from baseline for a period $>15\text{ min.}$



Cont...

- Suspected:
 - Hypertension accompanied by an elevated central venous pressure (or neck vein distension)
- Catastrophic entity
 - Results in acute right ventricular failure and death
- Death occurs within 1-2hrs of the event
- PE is frequently undiscovered until biopsy



Cont...

2) Sub massive PE

- All acute PE which are not meeting the definition of massive PE are considered submassive PE

3) Saddle PE

- PE that logdes at the bifurcation of the main pulmonary artery into the right and left pulmonary arteries



Cont...

- Most are submassive
- Retrospective study of 546 consecutive patients with PE, 14 (2.6 percent) had a saddle PE



Epidemiology

- In a study of more than 42million deaths that occurred over a 20 year duration, almost 600,000 patients (approx. 1.5 percent) were diagnosed with PE



Prognosis

- Without treatment:
 - Mortality is 30%
- With accurate diagnosis and treatment:
 - Mortality is 2-8%



1) RV Dysfunction

- Meta-analysis of 7 studies (3395 normotensive or hypotensive patients with PE) found
 - RV dysfunction was associated with a two fold increase in PE-related mortality
- RV dysfunction also predicted recurrent PE or DVT
- Persistent RV dysfunction
 - Likely to have recurrent PE, recurrent DVT or PE related death



2) Brain Natriuretic Peptides

- Elevated BNO or N-terminal pro-brain natriuretic peptide (NT-proBNP)
 - Predicts RV dysfunction and mortality
- Meta-analysis of 16 studies found
 - Short-term mortality was increased 6-fold among patients with $\text{BNP} > 100\text{pg/ml}$
 - &
 - 16 fold among patients with an NT-proBNP $> 600\text{ng/L}$

Cont...

- Another meta-analysis of 13 studies (1132 patients) found
 - 30 day mortality was increased among patients with an elevated BNP or NT-proBNP

3) RV Thrombus

- Patients with PE and a right ventricular thrombus have a higher 14 day mortality and 3 month mortality than patients without an RV thrombus

4) Serum Troponins

- Elevated S-troponin levels identify patients with PE who are at increased risk for death

Pathophysiology

- Most PE arise from thrombi in the deep venous system of the lower extremities
- May originate in the right heart or the pelvic, renal or upper extremity veins
- Iliofemoral veins are the source of most clinically recognizes PE

Cont...

- 50 to 80 % of iliac, femoral and popliteal vein thrombi (proximal vein thrombi) originate below the popliteal vein (calf vein thrombi) and propagate proximally
- Most calf thrombi resolve spontaneously and only 20-30 % extend into the proximal veins
- Most thrombi develop at sites of decreased flow such as valve cusps or bifurcations

Risk Factors

- PE is a complication of DVT
 - 50% of cases with confirmed DVT
- Factors that promote development of DVT increase the risk of PE
- Include
 - Immobilization
 - Surgery within last 3 months
 - Stroke
 - Paresis

Cont...

- Paralysis
- History of venous thromboembolism
- Malignancy
- Central venous instrumentation within last 3 months
- Chronic heart disease
- Additional Risk Factors in Women
 - Obesity (BMI more than or equal to 29 kg/m²)
 - Heavy cigarette smoking >25 cigarette/day
 - Hypertension

Symptoms and Signs

- Specific symptoms and signs are not helpful diagnostically because their frequency is similar among patients with or without PE
- Most common symptoms
 - Dyspnea at rest or with exertion (73%)
 - Pleuritic pain (44%)
 - Cough (34%)
 - > 2 pillow orthopnea (28%)

Cont...

- Calf or thigh pain (44%)
- Wheezing (21%)
- Onset of dyspnea occurs usually within seconds (46%) or minutes (26%)
- Most common signs
 - Tachypnea (54%)
 - Tachycardia (24%)
 - Rales (18%)
 - Decreased breath sounds (17%)

Cont...

- An accentuated pulmonic component of the 2nd heart sound (15%)
- Jugular venous distension (14%)
- Symptoms and signs of lower extremity DVT were common (47%)
- Include:
 - Edema
 - Erythema
 - Tenderness
 - Palpable cord in the calf or thigh

Diagnosis

- Symptoms and signs of PE are:
 - Highly variable
 - Non-specific
 - Common among patients with or without PE

DIAGNOSTIC TESTS



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1) Laboratory

- Routine labs non-specific
- Include:
 - Leukocytosis
 - Increased ESR
 - Elevated serum LDH or AST with a normal serum bilirubin

2) ABGs

- Limited role in diagnosing PE
- Usually reveal Hypoxemia, Hypocapnia and Respiratory Alkalosis
- A PaO between 85 and 105mm Hg exists in 18% of patients with PE
- Increased complications if PaO₂ < 95% at the time of diagnosis

2

3) Brain Natriuretic Peptide

- Typically greater in patients with PE compared to patients without PE
- BNP
 - Sensitivity 60%
 - Specificity 62%
- Magnitude of the elevation of BNP or its precursor NT-proBNP
 - Correlates with the risk of subsequent complications and hospitalization
- BNP and NT-proBNP
 - Prognostic role in PE

4) Troponin

- Troponin I and T elevated in 30-50% of patients with moderate to large PE
- Troponin elevations usually resolve within 40hrs in PE
- Not useful for diagnosis but associated with adverse outcomes

5) Electrocardiography

- Findings common in patients without PE
- 50 diagnostic usefulness limited
- Prospective Study
 - 70 % of patients with acute PE had ECG abnormalities
 - Non-specific ST-segment and T-wave changes (most common)
- Historical changes S1Q3T3, right ventricular strain
 - Common with massive acute PE and cor pulmonale

Cont...

- ECG abnormalities associated with a poor prognosis:
 - i. Arterial Arrhythmias
 - ii. RBBB
 - iii. Inferior Q-waves
 - iv. Precordial T-wave inversion and ST segment changes

Chest Radiography

- Abnormalities common in patients with PE
- Not helpful diagnostically because similarly common in patients without PE
- Atelectasis (69%)
- Pulmonary parenchymal abnormality (58%)
- Pleural effusion (47%)
- 12% CXR
 - normal

7) V/Q Scan

- Most extensive evaluation of V/Q scan
PIOPED.
- Prospective Investigation of Pulmonary Embolism Diagnosis (PIOPED)
- Accuracy was determined by comparison to the reference standard, the Pulmonary Angiogram
- Diagnostic Accuracy:
 - Greatest when V/Q scan combined with Clinical Probability

Cont...

- Patient with high clinical probability of PE + high probability V/Q scan
 - 95% likelihood of having PE
- Low clinical probability of PE + low probability of V/Q scan
 - 4% likelihood of having PE
- Normal V/Q scan virtually excluded PE

Ultrasound

- Lower extremity venous ultrasound for DVT
- Serial exams used to monitor for venous thrombosis

D-dimer

- Degradation product of cross-linked fibrin
- Measured in serum by ELISA or a semi-quantitative latex agglutination assay
- ELISA more accurate
- Latex agglutination more rapid
- Typically, a level $>500\text{mg/ml}$ is abnormal
- D-dimer assays for the diagnosis of PE have good sensitivity and negative predictive value, but poor specificity and positive predictive value

Cont...

- Sensitivity
 - D-dimer levels abnormal in 95% of patients with PE
- Negative Predictive Value
 - Normal D-dimer levels have a 95% likelihood of not having PE
- Specificity
 - D-dimer levels are normal in only 25% of patient without PE

Cont...

- Normal D-dimer level exclude recurrent PE in patients with prior venous thrombosis or PE
- D-dimer level $<500\text{ng/ml}$ sufficient to exclude PE unless the pretest probability of PE is high

Angiography

- Pulmonary Angiography is the Gold Standard in the diagnosis of PE
- Negative Pulmonary
 - Angiogram excludes clinically relevant PE
- Pulmonary Angiography is generally safe and well tolerated in :
 - The absence of hemodynamic instability caused by acute, severe pulmonary hypertension

Cont...

- Mortality of the procedure is less than 2 percent
- Morbidity occurs in approximately 5% of patients, and is usually related to:
 - Catheter insertion
 - Contrast reactions
 - Cardiac arrhythmia or
 - Respiratory insufficiency

CT-Pulmonary Angiography (CT-PA)

- Used increasingly as a diagnostic modality
- Benefit:
 - Ability to detect alternative pulmonary abnormalities that may explain the patient's clinical condition
- Diagnostic accuracy of CT-PA:
 - Best studied by a study (PIOPED II)
- Suggests:
 - CT-PA requires concomitant pretest clinical probability assessment to be an effective diagnostic tool for conforming or excluding PE

Cont...

- Clinical probability was determined by using Well's criteria
- It includes:
 - Clinical symptoms of DVT (3 points)
 - Other diagnosis less likely than PE (3 points)
 - Heart rate >100 (1.5 points)
 - Immobilization $>$ or equal to 3 days or surgery in previous four weeks (1.5 points)
 - Previous DVT/PE (1.5 points)
 - Hemoptysis (1 point)
 - Malignancy (1 point)

For Low Risk Outpatient Populations

- Pulmonary Embolism Rule-out Criteria (PERC)
- Eight factors constitute PERC:
 - Age less than 50yrs
 - Heart rate less than 100bpm
 - Oxyhemoglobin saturation $>$ or equal to 95%
 - No hemoptysis
 - No estrogen use
 - No prior DVT or PE
 - No unilateral leg swelling
 - No surgery or trauma requiring hospitalization within the past four weeks

MR Angiography (MRA)

- Use of MRA for the diagnosis of PE is limited by:
 - Respiratory & cardiac motion artifact
 - Suboptimal resolution
 - Complicated blood flow patterns
 - Magnetic susceptibility effects from the adjacent air-containing lung

Echocardiography

- Patients with PE have echocardiographic abnormalities of acute PE (30 to 40%)
 - Increased right ventricular (RV) size
 - Decreased RV function
 - Tricuspid regurgitation
- In cases of massive PE:
 - Abnormalities are more likely and echocardiography may be useful

Cont...

- Additional echocardiographic findings of PE include:
 - PE among patients with an RV thrombus appears to be >35%
 - 4% of patients with PE have an RV thrombus
 - Regional wall motion abnormalities
- Presence of RV dysfunction or an RV thrombus detected by echocardiography has prognostic implications

Alveolar Dead Space

- Alveolar dead space fraction (ADF) rises with acute PE
- Two trials have looked at the combination of the ADF and D-dimer in diagnosing PE:
 - Most patients with PE have an abnormal ADF (defined as >20 percent) or a positive D-dimer (98%)
 - Most patients with a normal ADF and a negative D-dimer do not have PE (98 percent)

Cont...

- The clinical utility of this approach is limited by
 - Common false positive results
 - Difficulty obtaining accurate ADF measurements
 - Poor availability of ADF measurements

TREATMENT



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1) Resuscitation

- Initial focus on stabilizing the patient
- Respiratory support
 - Supplemental oxygen for hypoxemia
 - Severe hypoxemia or respiratory failure
 - Intubation & mechanical ventilation

2) Hemodynamic Support

- If patient is hypotensive i.e., systolic B.P < 90mmHg
OR
- A drop in systolic B.P > or equal to 40mmHg from baseline
 - I/V fluid first line of therapy usually normal saline
- Fluids should be given cautiously

General Approach

- Diagnostic evaluation should be performed quickly
- If PE is confirmed, long term anticoagulation indicated
- In contrast, anticoagulation can be discontinued if PE is excluded
- If PE is confirmed, thrombolytic therapy should be considered
 - Anticoagulation temporarily discontinued during thrombolytic therapy

Cont...

- Inferior Vena Caval Filter placement considered for patients with confirmed PE
 - If anticoagulation is contradicted, fails or causes complications (e.g., severe bleeding)
- Patients in whom thrombolysis is either
 - Contradicted or
 - Unsuccessful
 - Embolectomy should be considered

Anticoagulation Therapy

- Reduces mortality
- Primary therapy for PE
- Prevents further clot formation, does not lyse existing thromboemboli
- Goal: Decrease mortality by preventing recurrent PE
- Efficacy:
 - Depends upon achieving a therapeutic level of heparin within first 24hrs of treatment

Cont...

- Pooled analysis of three anticoagulation trials:
 - Risk of PE is 25% if the APTT was not therapeutic within 24hrs of initiation of heparin
- Therapeutic Options:
 - i. Subcutaneous low molecular weight heparin (LMWH)
 - ii. Intravenous unfractionated heparin (IV UFH)
 - iii. Subcutaneous unfractionated heparin

Cont...

- Anticoagulation initiated in all patients with
 - High clinical suspicion of PE or
 - In whom PE has been conformed

- SC LMWH is the preferred anticoagulant
 - In most hemodynamically stable patients with PE

Cont...

- IV UFH when there is persistent hypotension due to PE (i.e., massive PE)
 - An increased risk of bleeding
 - Concern about subcutaneous absorption (e.g., morbid obesity)
 - Thrombolysis being considered
- Use UFH (either IV or CS) when the creatinine clearance is $<$ or equal to 30mL/min.

Cont...

- Rationale:
 - Efficacy of LMWH not well studied in patients with PE and severe renal failure
- Severe renal insufficiency alters the pharmacokinetics of the anticoagulants
 - Requiring activity be monitored:
 - Convenient to monitor UFH than SC LMWH (as APTT readily available than anti-xa assays)

Cont...

- SC LMWH results in:
 - Lower mortality
 - Fewer recurrent thrombotic events
 - Less major bleeding
 - Has greater bioavailability
 - More predictable pharmacokinetics
 - Once or twice daily administration
 - Fixed dosing
 - A decreased likelihood of thrombocytopenia

Oral Anticoagulant

- Warfarin
 - Can be initiated on same day after heparin is begun
 - Should not be initiated prior to heparin as warfarin alone is associated with a 3-fold increase in the incidence of recurrent PE
- Dose:
 - Initially 5mg for first 2 days then adjust according to INR (2-3)

Thrombolysis

- Accelerates the lysis of acute PE
- Improves RV function & perfusion
- Persistent hypotension due to PE (i.e., massive PE) most widely accepted indication for therapy
- Associated with an increased risk of major hemorrhage
- Agents:
 - i. Streptokinase (SK)
 - ii. Recombinant tissue type plasminogen activator (TPA, alteplase)
 - iii. Recombinant human urokinase (UK)

Inferior Vena Caval Filters (IVF)

- Provide a screen allowing blood to pass through while preventing large emboli from traveling from the pelvis or lower extremities to the lungs.
- Indications:
 - Absolute contraindication to anticoagulation (e.g., active bleeding)
 - Recurrent PE despite adequate anticoagulant therapy
 - Complication of anticoagulation (e.g., severe bleeding)

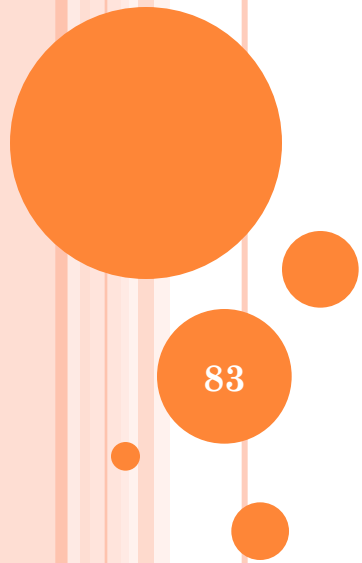
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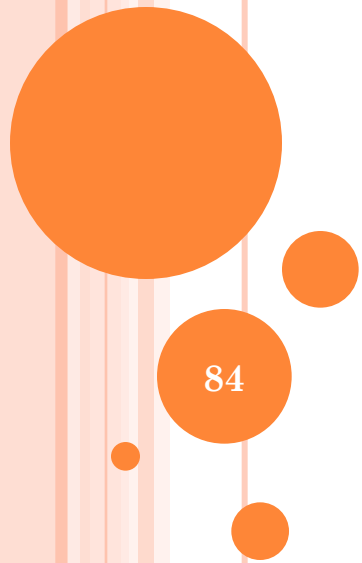
- Hemodynamic or respiratory compromise that is severe enough that another PE may be lethal
- **Complications:**
- Rare:
 - Complications related to insertion process (e.g. bleeding)
 - Filter misplacement
 - Filter migration
 - Filter erosion perforation of the IVF
 - IVC obstruction due to filter thrombosis

Embolectomy

- Removal of emboli performed by using catheters or surgically
- Considered when a patient's presentation is severe enough to warrant thrombolysis (e.g., persistent hypotension due to PE) but this approach either fails or is contraindicated
 - Catheter embolectomy
 - Rheolytic embolectomy
 - Rotational embolectomy
 - Surgical embolectomy

Thank
you





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