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Pulmonary embolism - Pulmonary thromboembolism in patient with rectal adenocarcinoma

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Abstract

Pulmonary thromboembolism (PTE) is potentially life-threatening disorder. The pathogenesis of pulmonary thromboembolism isn't fully understood, but it is believed to involve imbalance between pro-coagulants and anticoagulants, as well as endothelial dysfunction and acute or chronic inflammation. Pulmonary embolism (PE) occurs when there is a disruption to the blood flow in the pulmonary artery or pulmonary branches by a thrombus that originated somewhere else. Risk factors for PE are deficiency of protein S,protein C deficiency, anti-thrombin III deficiency, LA-lupus anticoagulant, factor V Leiden deficiency, antiphospholipid syndrome (APLS), previous surgical treatment, chemotherapy, immunosuppressive drugs, immobility, overweight ,oral contraceptives, pregnancy ,history of vein thrombosis ,thrombophlebitis , varicose veins. There is a relationship between higher body mass index (BMI) and VTE, and patients with severe obesity (BMI ≥ 35) have higher risk of pulmonary thromboembolism compared with those of normal BMI. Patients with pulmonary thromboembolism may present with a spectrum of symptoms, including chest pain, shortness of breath, tachycardia, hemoptysis, asymmetric pitting edema on legs, prominent superficial collateral vessels, tenderness and pain to palpation of the leg, red or purple color, warmth on the affected leg. The diagnostic work-up of suspected pulmonary embolism includes D-dimer testing, ECG, ultrasonography of heart and CT angiography. Direct oral anticoagulants are first-line treatment options for venous thromboembolism because they are associated with a lower risk of bleeding disorders than vitamin K antagonists. Use of thrombolysis should be limited to pulmonary embolism associated with haemodynamic instability. Anticoagulants should be continued for at least 3 to 6 months to prevent early recurrences and relaps of PE. Haematological malignancies, lymphoma, lung cancers and colorectal cancers are the most common cause of PE

Conclusion Pulmonary embolism is medical emergency which requires fast diagnosis and treatment. Direct oral anticoagulants(DOAC) are first-line treatment options for venous thromboembolism because they are associated with a lower risk of bleeding disorders than vitamin K antagonists. There is a important relationship between BMI and pulmonary thromboembolism, and patients with severe obesity (BMI ≥ 35) have higher risk of VTE and PE compared with those patients with normal BMI

Key words: pulmonary embolism, DVT, oral anticoagulantants, oral contraceptives

Pulmonary embolism - Risk factors, diagnosis and treatment

Pulmonary embolism (PE) is partial or complete occlusion of one or more pulmonary arteries, due to thrombus. Non-thrombotic pulmonary emboli include: gas, fat, septic embolism. (1)

Risk factors (3)
- primary hypercoagulable states (protein S deficiency, protein C deficiency , deficiency of antithrombin III ,lupus anticoagulant (LA), deficiency of factor V Leiden)
- Surgical intervention (<4 weeks)
- Prolonged immobility
- malignancies: including multiple myeloma ,lymphoma, rectal adenocarcinoma, haematological disorders
- Medications (oral contraceptives, thalidomide, lenalidomide, chemotherapy, immunosuppressive drugs) (2)
- Pregnancy
- History of DVT, thrombophlebitis, varicose veins
- presence of certain venous aneurysm

Diagnosis of pulmonary thromboembolism
Clinical symptoms:(4) (5)
- ✓ asymmetric edema of legs
- ✓ prominent superficial collateral vessels
- ✓ tenderness, warmth and pain of the affected leg and change in skin color (red or purple)
- ✓ Dyspnea
- ✓ Tachycardia
- ✓ atypical chest pain which worsens on inspiration or when patient coughs,
- ✓ Hemoptysis

ECG: tachycardia, incomplete or complete right bundle branch block(RBBB) high amplitude of R wave in V1, right axis deviation, inversion of T-wave in the right precordial leads, $S_I Q_{III} T_{III}$ pattern (7)

Risk stratification for Pulmonary thromboembolism with Wells and Geneva score:

Wells score criteria (13)
- clinical signs and symptoms of DVT = 3
- differential diagnosis is less likely than pulmonary thromboembolism = 3
- pulse 100/min = 1.5
- history of pulmonary embolism or DVT = 1.5
- immobilization for 5 or more consecutive days or surgical intervention in the previous 4 weeks = 1.5
- Hemoptysis= 1
- malignancy (treatment with chemotherapy in last 6 months or palliative treatment) = 11

Interpretation of Wells score:0-1: low risk,2-6: moderate risk,>6: high risk

Geneva score (range from 0 to 16 points)
Interpretation of Geneva score: low, intermediate, and high risk:(14)(15)
1. Age
   - o 60–79 years = 1
   - o 80+ years = 2
2. history of previous venous thromboembolism: DVT or PE = 2
3. heart rate>100/min = 1
4. previous surgical procedure last 4 weeks = 3
5. PaO2 (partial pressure of O2 in arterial blood)

- o <49mmHg = 4
- o 49-59mmHg = 3
- o 60-71mmHg = 2
- o 72-82mmHg = 1
6. $PaCO_2$ (partial pressure of CO_2 in arterial blood)
- o <35mmHg = 2
- o 35-39mmHg = 1
7. chest X-ray
- o atelectasis = 1
- o elevation of hemidiaphragm = 1

Probability of PE due to Geneva score: low probability < 5 points, intermediate probability 5 - 8 points**,** high probability >8 points**.**

- **Diagnosis of PE**
  - o Laboratory analysis with D-dimer (elevated) (10)
  - o 1/3 of the patients diagnosed with PE have elevated serum troponin I concentrations. Troponin I tests are able to identify patients with right ventricle dilatation. Also, troponin I assays are helpful in detecting minor myocardial damage due to pulmonary embolism. (6)
- **Chest X-ray.** Sensitivity and specificity of chest x-ray signs:
  - o Hampton hump: peripheral wedge of airspace opacity, being a sign for lung infarction (20%)
  - o Pleural effusion
  - o elevation of diaphragm (8)
- **Echocardiography**: right heart dilation, McConnell's sign shows right ventricle wall akinesis, sparing the apex
- **Ventilation-perfusion scan (V/Q scan**)
- **Computed tomography (CT or CTPA).** CT pulmonary angiography (CTPA) shows filling defects within the pulmonary vessels. When the artery is seen in its axial plane, the central filling defect from the thrombus is being surrounded by a thin rim of contrast, called "polo mint sign''.(9)
- **Magnetic resonance (MRI).**

Treatment for pulmonary embolism
- Anticoagulants. Anticoagulants which are used to treat pulmonary embolism are: unfractionated heparin, low-molecular heparin, Factor Xa inhibitors Warfarin. Direct oral anticoagulants like rivaroxaban, apixaban are first-line therapy. Patients with creatinine clearance < 30 ml/min ,should be treated with enoxiparine or fraxiparine. Systemic thromboembolic medications should be considered in massive PE treatment. (16)
- Pulmonary embolectomy
- Percutaneous thrombectomy. (11)

Differential diagnosis: Acute coronary syndrome**,** cardiogenic shock ,heart failure, cor pulmonale, cardiomyopathy **,**acute pericarditis, heart tamponade, acute coronary syndrome ,acute respiratory distress syndrome (ARDS)**,**acute respiratory failure, emphysema, mitral stenosis, mitral regurgitation ,myocardial infarction, pulmonary hypertension, superior v.Cava syndrome ,inferior v.Cava syndrome, Takayasu arteritis

Prognosis of pulmonary embolism

The outcome of pulmonary embolism (PE) is determined by factors such as the size and location of the thrombus and any pre-existing heart or lung conditions. The majority of individuals who have a PE usually recuperate completely, however, a few may have persistent symptoms like dyspnea.

Case report

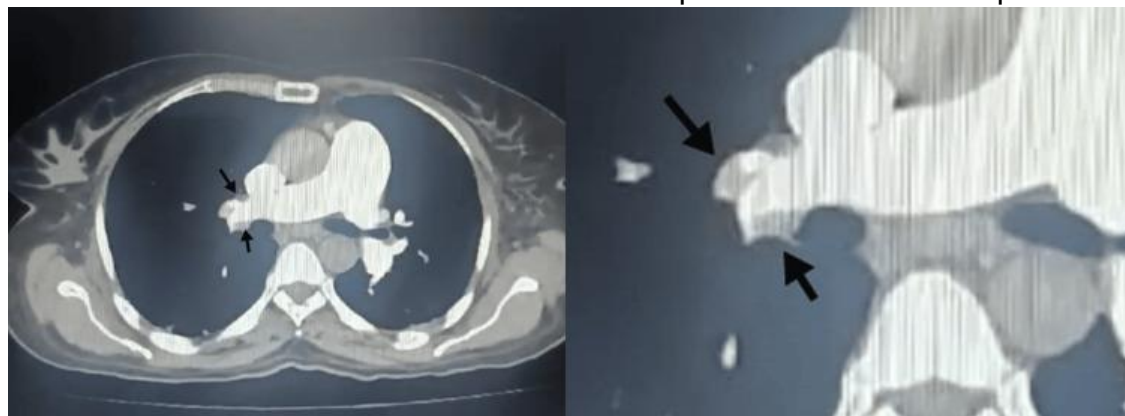Pulmonary thromboembolism in patient with rectal adenocarcinoma.

A 65-year-old female patient came to a local medical facility with chest pain and exertional dyspnea, blood cough, neck pain, malaise and weakness, which began few

days ago.The patient has surgery for rectal adenocarcinoma 1 month ago. From her past medical history, she has hypertension and surgery for rectal adenocarcinoma (1 month ago) The patient is hospitalized for diagnostic investigations and further treatment. On physical examination she had dyspnea and tachycardia. Blood pressure 130/80, pulse 75/min. Geneva score=8, Wells score =8.5 which showed high risk for pulmonary thromboembolism.

The patients' electrocardiogram showed a normal sinus rhythm with a normal QRS axis and T-wave. She had stable vital signs. Her routine laboratory panel showed normal renal function,

high-sensitivity troponin-I, and lactate levels, increased CRP, increased d-dimer level, normal PT, TT, APTT, INR. Anti Xa . Blood gas analyses were normal. CT pulmonary angiography (CTPA) showed pulmonary thromboembolism on the right lung, posterolateral.

During hospitalization, transfusiologist was consult, she was treated with anticoagulants and antibiotics. He was discharged in a stable general condition with recommendation to take Rivaroxaban 15 mg 1x1 and Relika 1x1.The patient didn't take the therapy, didn't consult with her doctors. After 3 weeks. PE relapsed and she was hospitalized again.

CTPA: The black arrows show thrombus located in pulmonary artery in right upper lobe

Discussion

The prevalence of pulmonary thromboembolism in patients with malignancy is currently estimated to be 0.5%, compared to 0.1% in the healthy population. 20% of patients with cancer can develop PE. Among different cancers, haematological malignancies, lymphoma, lung cancers and colorectal cancers are the most common cause of PE.

Interestingly, certain histological types of rectal cancer, such as adenocarcinomas, have been more strongly associated with the development of pulmonary thromboembolism (PE). This correlation may be attributed to the ability of some tumors to induce a hypercoagulable state through the increased production of procoagulants. In fact, thrombosis associated with cancer is a common complication of malignancy and important cause of mortality and morbidity in patients with malignancy.

Malignant cells have the ability to produce procoagulants and fibrinolytics. Female sex and older age are considered critical risk factors for pulmonary embolism. Also, comorbidities like heart disease, heart failure, acute coronary syndrome, acute pericarditis, heart tamponade hypertension,renal failure, obesity, previous surgery, prolonged immobility, and history of thromboembolism increase the risk of relapse of pulmonary embolism .

Surgical removal of cancer is linked to an higher risk of vein thrombosis and PE. Chemotherapy is linked to an higher risk of thromboembolism in patients with malignancy. The risk of PE is higher due to the use of many chemotherapeutic agents, immunosuppressive drugs and corticosteroids. The placement of a central venous catheter, in v.femoralis, also increases the risk of pulmonary embolism. Anorectal carcinoma is a common variant of solid organ malignancies, and it has a higher risk of complications like PE and pulmonary hypertension.

Our 65-year old patient had several risk factors, such as female sex, the presence of rectal adenocarcinoma and previous history of abdominal surgical procedure, which explains her higher risk of pulmonary thromboembolism.

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