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A Mini-review on Assessment and Management of Pulmonary Embolism

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ABSTRACT

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Pulmonary embolism is a major clinical challenge with significant morbidity and mortality. It has been noted that prompt and appropriate management may reduce the adverse outcomes of the condition. In recent years, extensive research has been conducted for the effective management of patients with pulmonary embolism. In this context, we aimed to produce a content that reflects the state-of-the-art regarding pulmonary embolism, which can be used as a guide in the management of patients with this difficult disorder. We suggest that the management should be individualized for each patient based on the clinical assessment of risk-benefit with certain therapeutic modalities.

Keywords: Pulmonary embolism, Evaluation, Management

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INTRODUCTION

Pulmonary embolism (PE) is a significant health concern and a major clinical challenge. It may lead to pulmonary hypertension and right ventricular dysfunction, and has a mortality rate of approximately 14%.[1] It has been noted that prompt and appropriate treatment can decrease mortality from this disease by about 25%.[2] This led to extensive research in the filed of assessment and management of PE in recent years. In this context, we aimed to review the most significant literature on this subject in order to produce a content that reflects the state-of-the-art regarding PE and which can be used as a guide in the diagnosis and treatment of this difficult disorder.

Assessment of PE

The risk factors for developing PE mainly include immobility, age >40 years, history of deep vein thrombosis, varicose veins, obesity, malignant disease, pregnancy, puerperium, oral contraception, surgery, trauma, myocardial infarction, heart failure, polycythaemia, connective tissue disease, congenital coagulation disorders, or genetic factors.[3,4] A patient with PEmay present with typical symptoms such as dyspnoea, pleuritic chest pain, tachycardia, fainting, syncope or atypical symptoms such as cough, substernal and pleuritic chest pain, haemoptysis, wheezing, cyanosis, and fever. In some cases, diagnosis is established during routine screening of deep venous thrombosis or only at autopsy.[5,6] At present, there is no diagnostic test for PE with 100% specificity and sensitivity. Some are better at excluding PE, such as D-dimers, while others are more suitable for confirming it, like spiral computed tomography; yet others can do both, but are often not diagnostic, like ventilation- perfusion lung scanning.[2] Initial investigations include chest X-ray, electrocardiogram, and arterial blood gases, combined with a focused history and physical examination, to rule out other differential diagnosis. Although pulmonary angiography remains the gold standard test for diagnosis of PE, the V/Q scan or CTPA are fundamental to decision making. The findings of V/Q scanning are given as high, intermediate or low probability for PE while a CTPA reports dichotomous PE. Treatment is required for patients with a high post-test probability.[7] Depending on the extent and age of the embolism, PE can be classified as 'massive' (more than half of the pulmonary arterial tree is occluded), 'submassive' or 'minor' embolism, and as 'acute' (of less than 48 hours' duration), 'subacute', or 'chronic'embolism respectively.[4] The PE Severity Index (PESI) and simplified PESI (sPESI) clinical scoresare extensively validated for the prognosis and risk stratification of patients with PE, based on which management options are appraised.[8]

Management of PE

Overall, the management of these can be divided in three components (a) primary treatment - aimed at patient stabilization and symptom relief along with

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resolution of vascular obstruction (b) secondary prevention of extension of the thrombus and reducing the risk of embolism, and (c) hemodynamic and respiratory support for patients with hemodynamic instability or contraindication for anticoagulation.[2]

(a) Primary treatment:

The major aim in treating the patients with massive or submassive PE is to remove the clot. Medical thrombolysis is performed with recombinant tissue plasminogen activator (rt-PA) with a dose of 100 mg in continuous IV infusion over 2 hours. However, the risk-benefit of thrombolysis should be considered for individual patients before decision making. Surgical interventions are rarely considered for patients with PE. In particular, surgical embolectomy (for acute patients) and thromboendarterectomy (for chronic patients) is suggested for patients in whom thrombolytic therapy is contraindicated and those who fail to respond to intensive medical thrombolytic treatment.[2,8] Interventional cardiology procedures such as suction embolectomy, fragmentation and distal dispersion, mechanical pulverization, catheter-guided local thrombolysis, and balloon angioplasty are valuable alternatives for patients who do not need cardiopulmonary resuscitation.[2] Thrombus aspiration catheters are effective for successful thrombus removal in patients with symptomatic PE.[9]

(b) Secondary prevention:

Subsequent to primary treatment, secondary prevention of recurrent PE is vital. Unfractionated heparin (UHF) has been the drug of choice for the treatment of PE for decades. In current clinical practice, it is reserved for patients in whom the use of fibrinolytic treatment is considered (intermediate- or high-risk PE), and for patients at a high risk of bleeding who are to receive anticoagulant therapy. Low-molecular weight heparin (LMWH) is prepared from the fractionation of UFH by chemical or enzymatic methods.[2,8] The safety and efficacy of LMWH is equivalent to UHF.[10] The use of LMWH is recommended in patients with acute PE.[2] Pentasaccharides (e.g. fondaparinux) are found to be effective and safe in terms of recurrent thromboembolic events, major bleeding events, and mortality.[11] The major advantage of fondaparinux is that it is not associated with heparin-induced thrombocytopenia and does not require monitoring.[2,8] Alternative drugs—such as dermatan sulphate (activates heparin cofactor II), orgaran (a mixture of heparin and dermatan sulphate), bivalirudin, hirudin, heparinoids, and argatroban, melagatran, and ximelagatran (direct thrombin inhibitors)—have been established in placebo-controlled studies for the prevention of thromboembolic disease for the management of patients with heparin-induced thrombocytopenia.[2,12] Vitamin K antagonists like warfarin, acenocoumarol, dicumarol and fluindione are generally recommended in hemodynamically stable patients with PE.[2,8] Noveloral anticoagulants including rivaroxaban (15 mg twice daily for 3 weeks followed by 20 mg once daily) and apixaban (10 mg twice daily for the first 7 days followed by 5 mg twice daily) offers a simple, single-drug approach for the acute and long-term management of patients with PE,[2] and are reported to have equivalent efficacy and reduced risk of major bleeding compared to the conventional treatment.[13,14] Placement of a permanent or temporary inferior vena caval filter is a suitable option for patients with high-risk PE who have contraindication for anticoagulation.[2,8] The most commonly available vena caval filters are Greenfield filter, the titanium Greenfield filter, the bird's nest filter, the Simon nitinol filter, and the Vena Tech filter.[15]

(c) Hemodynamic and respiratory support:

It is a fundamental part of treatment as acute circulatory failure is found to be the most significant cause of mortality in majority of patients with acute massive PE. Dobutamine and dopamine are indicated in PE patients with low cardiac index. They should be administered to compensate right heart failure and to treat cardiogenic shock. Noradrenaline is a valuable treatment option for patients with hypotension. Inhaled nitric oxide is reported to improve hemodynamic status and gas exchange. Saline (<500 mL) is given to increase cardiac output in patients with low cardiac output and sustained systemic pressures. Mechanical ventilation with nasal oxygen should be given to reverse hypoxemia. During the mechanical ventilation, care must be taken not to cause an excessive rise in intrathoracic pressure. Non-steroidal anti- inûammatory agent is useful to relieve pleuritic chest pain, a common symptom in patients with PE.[2,8]

Although several guidelines are available for the management of patients with PE, physicians treating this condition frequently come across various clinical scenarios that demands difficult management decisions and for which evidence-base is not substantial.[16] These conditions may include treating pregnant women with PE, patients with cerebral infarct and acute PE, patients with cardiac arrest and PE, patients with PE following stroke or recent surgery, patients with right

atrial thrombus, patients with inferior vena cava filters, patients who failed to respond to the initial anticoagulation therapy, etc. We suggest that the management should be individualized for such patients with PE based on clinical assessment of risks and benefits of therapeutic modalities.

Take home message

The management of patients with PE relies upon rapid identification, risk stratification and thrombolytic/ anticoagulation treatment. Despite advances in diagnostic strategies, diagnosis of PE remains a major clinical problem. Clinical risk scores are valuable tools to stratify patients by the risk of mortality and to decide the management options. The treatment of PE requires both short-term and long-term view. Patients may require receiving oral anticoagulants for several months or years. We conclude that the management should be individualized for each patient with PE based on clinical assessment of risks and benefits of therapeutic modalities.

END NOTE

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Editorial Comments:

The subject is of interest due to the incidence of the disease in an acute setting. Awareness is the key to early detection and efficient management in the clinical setting. The article discusses the recent trends in detection, evaluation and management

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