CASE REPORT

Transforming pulmonary embolism care: advanced catheter techniques in Pakistan: a case report

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Abstract

Although post-operative acute pulmonary embolism (PE) is relatively rare, it poses a substantial risk of morbidity and mortality. We report the case of a 45-year-old hypertensive woman who presented with acute chest pain and dyspnoea eight days following a hysterectomy. On admission, she was tachycardic, hypotensive, and hypoxic. Transthoracic echocardiography revealed right ventricular dilation, a reduced tricuspid annular plane systolic excursion (TAPSE) of 12 mm, and a positive McConnell sign. Her Computed tomography pulmonary angiography confirmed bilateral pulmonary emboli. Due to a recent major surgery, systemic thrombolysis was contraindicated. Catheter-directed thrombolysis (CDT) was initiated, administering alteplase at 1 mg/hour per catheter. The patient demonstrated rapid clinical improvement, with marked reduction in oxygen and vasopressor support. She was discharged on rivaroxaban and resumed normal activities within one week. This case underscores the efficacy of CDT as a life-saving alternative in high-risk post-operative PE, especially in resource-constrained settings.

Keywords: Pulmonary embolism, Thrombolysis, Echocardiography.

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Introduction

Acute massive pulmonary embolism is a severe and potentially life-threatening condition that necessitates immediate intervention. Systemic thrombolysis has traditionally been the preferred method for high-risk cases, provided that the risk of bleeding is manageable. This treatment offers significant benefits, including reduced mortality, a lower risk of developing chronic thromboembolic pulmonary hypertension, and improved quality of life. However, it is also associated with an increased risk of bleeding complications. For patients who are not suitable candidates for systemic thrombolysis, alternative treatments should be considered. This report describes the management of a 45-year-old woman in a haemodynamically unstable state due to massive pulmonary embolism, who was contraindicated for systemic thrombolytic therapy.

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Case Report

A 45-year-old woman with a known history of hypertension, who had recently undergone a hysterectomy for dysfunctional uterine bleeding and multiple fibroids (eight days prior), presented to a general practitioner with complaints of chest pain and shortness of breath over the past 24 hours. An electrocardiogram (ECG) was carried out, and she was administered anxiolytics before being referred to another hospital. After several hours of initial assessment at that hospital, she was transferred to the National Institute of Cardiovascular Disease, for further management on February 28, 2024.

The clinical examination revealed a pulse rate of 140 beats per minute, a blood pressure of 88/45 mm Hg, and a respiratory rate of 30 breaths per minute. Oxygen saturation was 84% on room air, and the temperature was 99.6°F. Supportive treatment was initiated in the emergency department while diagnostic investigations were carried out. Echocardiography showed a normal-sized left ventricle (LV) with normal systolic function (ejection fraction 50-55%) and a dilated right ventricle (RV), with a tricuspid annular plane systolic excursion (TAPSE) of 12, a positive McConnell sign, and a pulmonary artery systolic pressure (PASP) of 50 mmHg. The patient's Pulmonary Embolism Severity Index (PESI)[1] score was 135, placing her in class V and indicating high risk. Additionally, Troponin I was positive, and D-dimer levels were elevated (6.9). Based on these findings, pulmonary embolism was suspected, and a computed tomography pulmonary angiography (CTPA) was performed (Figure 1).

The patient was assessed for systemic thrombolysis, but her recent major surgery presented a relative contraindication. In consultation with the pulmonary hypertension team, the intensivist decided to proceed with catheter-directed thrombolysis. Due to the absence of specialised catheters for this procedure, two 7 French

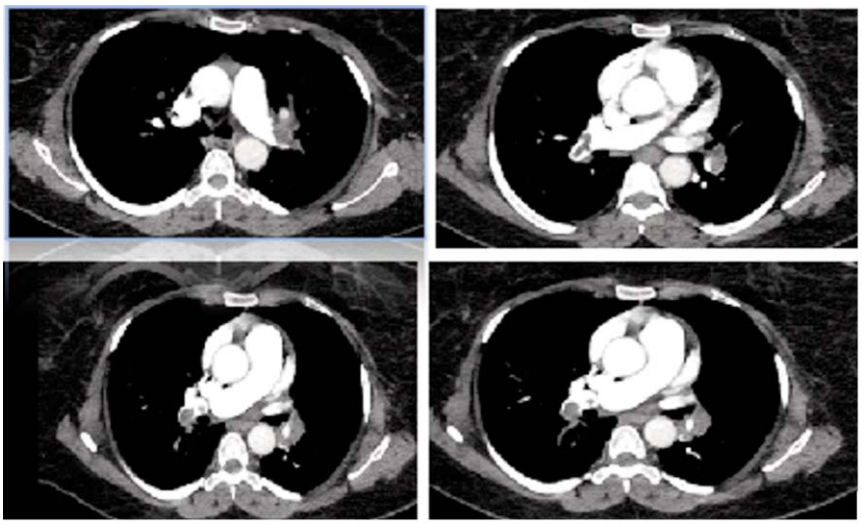

Figure-1: CTPA showing embolism in bilateral pulmonary artery.

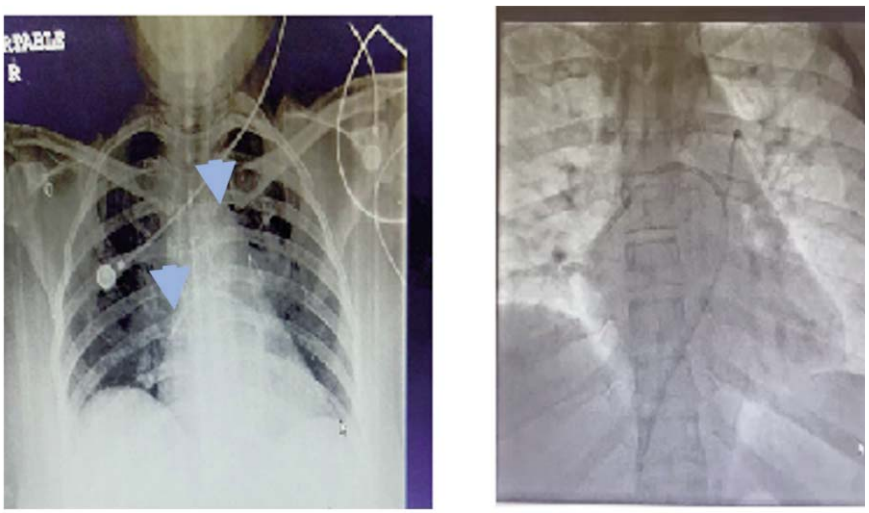

Figure-2: chest X-ray showing bilateral pulmonary arterial catheters (arrows marked)

multipurpose guiding catheters were inserted into the bilateral mid pulmonary arteries (Figure 2). Manual side holes were fashioned near the catheter tips to facilitate effective thrombolytic delivery within the pulmonary arterial bed. Thrombolysis was commenced with tPA at a rate of 1mg per hour via both catheters. Within three to four hours, the patient showed notable improvement, including a significant decrease in her oxygen and norepinephrine needs. The echocardiogram performed the following day revealed a dilated right ventricle with reduced systolic function, a TAPSE of 15, and a pulmonary artery systolic pressure of 25-30mmHg. Over the next two days, the patient's condition continued to improve, with reduced oxygen requirements and stable haemodynamics. She was discharged after two days on direct oral anticoagulants (DOACs), specifically Rivaroxaban 15mg twice daily for 21 days, with instructions for follow-up and long-term anticoagulation management. She resumed her normal activities at home within a week. Informed consent for publication of the case report was obtained.

Discussion

Anticoagulation alone has shown to be effective in treating low-risk pulmonary embolism (PE).[2] However, the management of pulmonary embolism (PE) is tailored to the patient's haemodynamic status and risk profile.[3] Specifically, thrombolysis is recommended for haemodynamically unstable, high-risk patients.[4] If thrombolysis is contraindicated or proves ineffective, surgical pulmonary embolectomy or percutaneous catheter-directed therapy may be considered.[5] Despite the potential life-saving benefits of reperfusion therapy, it is not appropriate for all pulmonary embolism patients due to the increased risk of bleeding.[6] The PEITHO trial [7] (Pulmonary Embolism Thrombolysis) demonstrated that systemic thrombolysis could reduce the risk of mortality by 50%, but it also raises the risk of major bleeding. Consequently, systemic thrombolysis is usually reserved for the highest-risk patients who are haemodynamically unstable.[8]

Catheter interventions for acute pulmonary embolism (PE) have been reported since the early 1990s. To improve outcomes and reduce complications, researchers are investigating catheter-based therapies for patients with intermediate- and high-risk PE. Catheter-directed thrombolysis (CDT) is a technique that administers thrombolytic agents directly into the obstructed branches of the pulmonary artery at lower doses compared to systemic methods. By targetting specific obstructed segments of the pulmonary artery, CDT aims to overcome the limitations of systemic thrombolysis, which can affect non-affected areas by diverting blood flow. Although CDT and other catheter-based approaches show potential, their effectiveness is still being determined, with current evidence mostly based on surrogate markers rather than

direct clinical results. The adoption of these therapies has been slow due to several reasons, including a lack of large-scale studies demonstrating their safety and efficacy, limited understanding of modern CDT for PE, and insufficient experience among operators.[9] Significant studies such as SEATTLE II, FLARE (FlowTriever Pulmonary Embolectomy Clinical Study), and EXTRACT-PE[10] underscore the potential of catheter-based therapies for managing acute pulmonary embolism (PE).

The complication profile of catheter-directed thrombolysis (CDT) is generally more favourable compared to systemic thrombolysis, although catheter interventions are not free from adverse events. One study found a major bleeding rate of 6.7% for high-risk pulmonary embolism (PE) and 1.4% for intermediate-risk PE, with minimal (<1%) rates of stroke and extremely rare occurrences of cardiac and pulmonary injury. Key predictors of adverse events for CDT in pulmonary embolism include factors such as massive PE, age over 70 years, and significant contraindications to thrombolytics, as highlighted in a study that reviewed patients undergoing catheter-directed interventions for acute PE.[11] These risks must be weighed against the expected benefits of catheter-directed thrombolysis (CDT), particularly for intermediate-risk pulmonary embolism (PE), where anticoagulation alone may suffice for most patients.

While the effectiveness of catheter-guided thrombolysis is well-established, what distinguishes this case is its application in a low- and middle-income country (LMIC) like Pakistan, where resource limitations are significant. This case reflects the innovative approach observed in previous medical advancements in Pakistan, such as the use of locally available materials for complex cardiac procedures. The successful implementation of makeshift catheters for CDT in this setting illustrates the feasibility of performing advanced interventional procedures in resource-constrained environments by creatively utilising available materials. This approach not only highlights the resourcefulness and adaptability of the medical professionals involved but also sets a precedent for similar life-saving interventions in other resource-limited settings.

Conclusion

In conclusion, this case highlights the successful utilization of catheter-directed thrombolysis for the management of high-risk pulmonary embolism in a resource-limited setting, employing locally accessible materials. The procedure was performed safely, leading to marked clinical improvement, thereby demonstrating the practicality and effectiveness of advanced endovascular interventions in constrained healthcare environments.

Consent: Consent for publication was obtained from the patient before publication.

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AUTHOR'S CONTRIBUTION:

FI, MSA & MIA: Concept, design, data analysis, interpretation, collected data, drafting, critically analysed content and final approval.

AH & JA: Concept, design, data analysis, interpretation and final approval.