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Sickle Cell Disease Revealed by Simultaneous Occurrence of Acute Coronary Syndrome and Pulmonary Embolism: A Case Report

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Case Report

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ABSTRACT

The simultaneous occurrence of acute coronary syndrome (ACS) and pulmonary embolism (PE) in patients with sickle cell disease (SCD) presents notable diagnostic and management challenges. This case report describes a 25-year-old woman with SCD who, after an uncomplicated laparoscopic cholecystectomy, developed acute retrosternal chest pain, severe dyspnea, and tachycardia. Diagnostic workup included several key methods: thoracic CT angiography was

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performed, revealing massive bilateral pulmonary embolism and a pulmonary infarct. Echocardiography demonstrated myocardial abnormalities, such as wall motion defects and a mildly reduced ejection fraction. Electrocardiography showed ST-segment depression and T-wave inversions in the anteroseptal leads. To confirm the presence of coronary artery disease, coronary angiography identified significant thrombotic stenosis in the proximal left anterior descending artery. Sickle cell disease was confirmed through a positive sickle cell test, which identified the characteristic hemoglobin S. Despite aggressive treatment, the patient's condition rapidly deteriorated, leading to death within 24 hours. This case underscores the critical role of a comprehensive diagnostic approach, including specific tests for SCD, in managing severe cardiovascular complications and highlights the need for tailored treatment strategies to improve patient outcomes.

Keywords: Sickle cell disease; acute coronary syndrome; pulmonary embolism; thrombotic complications.

1. INTRODUCTION

The association between sickle cell disease (SCD) and cardiovascular manifestations such as acute coronary syndrome (ACS) and pulmonary embolism (PE) represents a complex and clinically significant area of study. SCD, characterized by abnormal hemoglobin, predisposes individuals to severe vascular complications. ACS and PE, acute cardiovascular events, present unique diagnostic challenges and therapeutic considerations in SCD patients. Understanding the pathophysiology and optimal management strategies is crucial for improving outcomes in this patient category. This article highlights a case study of a young woman whose sickle cell disease was revealed by the simultaneous occurrence of acute coronary syndrome and pulmonary embolism, both of which contributed to a fatal outcome.

2. CASE REPORT

This involves a 25-year-old female patient admitted to the visceral surgery department for acute cholecystitis, who underwent uneventful laparoscopic cholecystectomy. Several hours postoperatively, she developed acute retrosternal stabbing chest pain rated 8/10 on the EVA scale, not radiating, associated with NYHA class IV dyspnea without orthopnea, and palpitations. On clinical examination, the patient was conscious, tachycardic at 110 bpm with a BP of 110/60 initially, then it gradually decreased, tachypneic with SaO2 of 75% on room air, febrile with a temperature of 38.5 degrees Celsius, and exhibited bilateral basal pleuropulmonary consolidation syndrome associated with signs of right ventricular failure. in view of this clinical presentation and the risk of post-operative embolism, thoracic CT angiography was immediately performed, revealing massive bilateral pulmonary embolism with probable PH signs, associated with a ventral left lower lobe pulmonary infarct and probable alveolo-interstitial involvement of infectious origin (Fig. 1). An echocardiogram was performed to assess the impact showed anterior, anteroseptal, and anterolateral wall motion abnormalities at basal and mid-ventricular levels, with mildly reduced EF and no RVSP elevation, estimated pulmonary hypertension (PH) of 40 mmHg, and a minimal pericardial effusion. given the presence of kinetic disorders on echocardiography, an electrocardiogram was performed, showing sinus rhythm at 60 bpm with ST-segment depression and T-waves inversion in antero-septal. two diagnoses were therefore evoked, either an associated coronary syndrome given the embolic context, or myocarditis given the perioperative context and the presence of the pericardial effusion, but what was not in favor of myocarditis was the negative inflammatory workup with a CRP of 4 and. Troponin I assay at 0/1 hour was positive. Coronary angiography was performed, with significant thrombotic stenosis of the proximal IVA without other lesions. (Fig. 2) Biologically, the blood test showed leukocytosis, anemia (hemoglobin 9 g/L) with a normal platelet count, with elevated total bilirubin, predominantly unconjugated, the rest of the biological tests were without anomaly. An etiological workup is therefore necessary before making a therapeutic decision. Sickle cell disease was suspected based on age, arterial and venous embolic manifestations, infectious and cardiovascular manifestations, confirmed by a positive sickle cell test. The patient's family declined thrombolysis after being informed of the benefits and risks and the patient's clinical course was rapidly unfavorable, leading to her death within 24 hours.

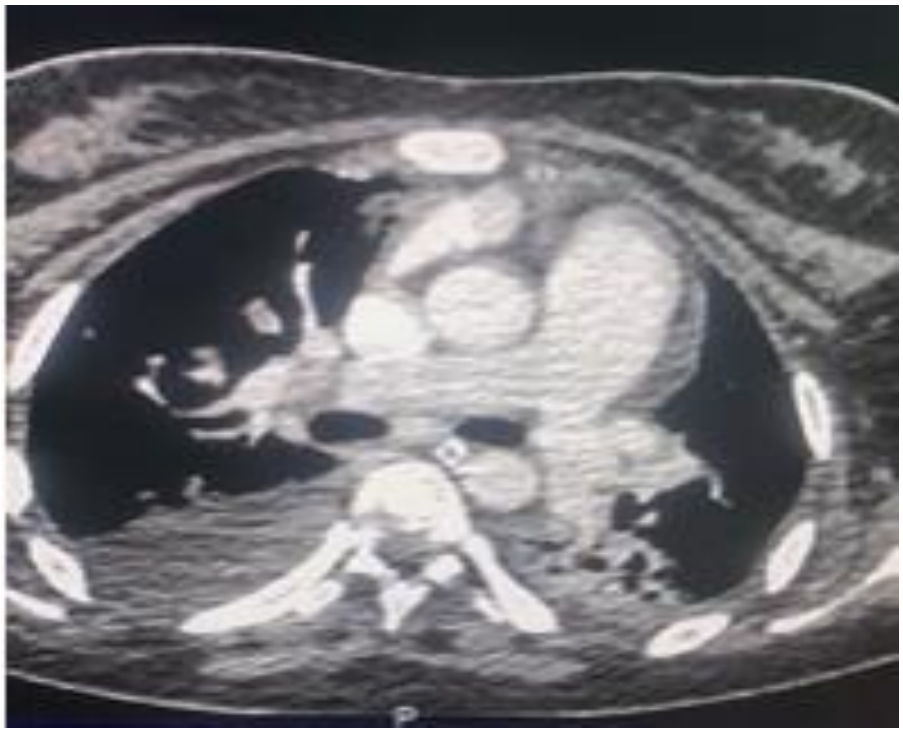

Fig. 1. Thoracic CT Angiography Showing Massive Bilateral Pulmonary Embolism

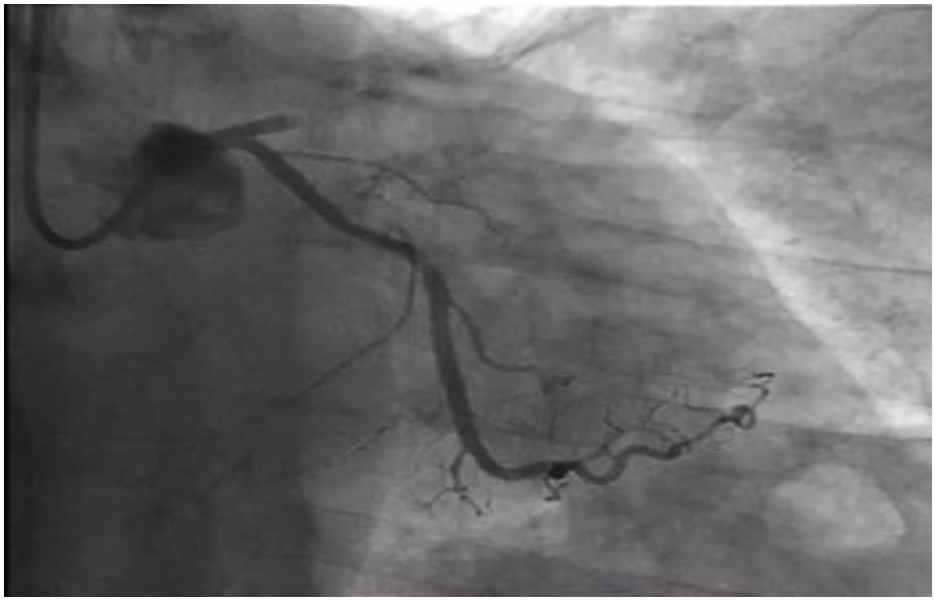

Fig. 2. Coronary Angiography Revealing Significant Thrombotic Stenosis in Proximal LAD

3. DISCUSSION

Sickle cell disease (SCD), resulting from a single point mutation in the hemoglobin beta gene, presents a formidable global health challenge, affecting over 300,000 infants annually and projected to rise to 400,000 by 2050 [1]. Hemoglobin S (HbS), known as sickle hemoglobin, structurally forms tetramers composed of two β-globin subunits. During deoxygenation, HbS polymerizes by aggregating with other hemoglobin molecules, forming large polymers that alter red blood cell morphology. Initially, HbS exhibits reduced oxygen affinity, promoting further polymerization and exacerbating its diminished oxygen-binding

capacity. This polymerization occurs because HbS substitutes the negatively charged glutamic acid at position β6 with a hydrophobic valine residue [2].

The intricate pathophysiology of sickle cell disease (SCD) involves microvascular blockages triggered by abnormal hemoglobin responses under conditions such as hypoxemia, acidosis, dehydration, and stress. These factors contribute to painful crises and tissue damage due to disrupted blood flow in affected tissues [3].

Contemporary data indicate rising cardiopulmonary complications in sickle cell anemia (SCA), accounting for about 40% of mortality, with acute myocardial infarction (AMI) comprising 8% to 21% of cases [4]. Acute coronary syndrome is frequently overlooked in SCD patients due to challenges in diagnosing ACS when chest pain occurs. Sickle cell crises often induce generalized body pain and atypical chest pain, compounded by the younger age and fewer traditional coronary risk factors in SCD patients. Electrocardiographic changes may be nonspecific or absent, further complicating ACS diagnosis and management, contributing to high mortality rates [5].

Several mechanisms have been proposed to explain myocardial ischemia or injury in sickle cell anemia (SCA) patients, including endothelial dysfunction from heightened inflammation, red blood cell sickling, abnormal myocardial microvasculature, and fibromuscular dysplasia of small myocardial blood vessels. Acute adhesion of sickled cells to neutrophils, platelets, and the endothelium initiates acute vasoocclusion, exacerbating myocardial ischemia. Released mediators, such as thrombospondin from hyperactive platelets and inflammatory molecules from sequestered leukocytes, further worsen vaso-occlusion, inducing vasoconstriction and aggravating ischemic conditions [6-7].

In a study by Alharbi et al. examining the impact of sickle cell disease (SCD) on acute coronary syndrome (ACS) and PCI outcomes using 2020 National Inpatient Sample (NIS) data, 1495 ACS patients with concurrent SCD were identified among 779,895 cases. SCD patients, predominantly younger (mean age: 59 vs. 66 years) and female (53% vs. 35%), showed higher rates of comorbidities like hypertension and chronic lung disease. Despite similar inpatient mortality rates, SCD patients had shorter hospital stays for STEMI and NSTEMI/UA cases. They also faced a significantly increased risk of coronary dissection [8].

The optimal management of acute myocardial infarction (AMI) in sickle cell anemia (SCA) patients remains to be definitively established. Supportive measures such as adequate hydration and oxygenation are recommended, with some studies suggesting the use of guideline-directed medical therapy for AMI in these patients [9].

Studies on Eptifibatide (Millennium Pharmaceuticals, Inc. [Cambridge, MA] and Merck & Co., Inc. [Kenilworth, NJ]) and Prasugrel (Daiichi Sankyo Company, Limited [Tokyo, Japan]) in patients with SCD suggest safety but no impact on pain crisis resolution or prevention, respectively. Statin therapy may reduce inflammatory markers and endothelial dysfunction in SCD, representing potential avenues for further research and intervention [10-11].

Regarding pulmonary embolism (PE) among sickle cell disease (SCD) patients in Pennsylvania from 2001 to 2006, Novelli EM's study found a higher incidence compared to non-SCD populations. SCD patients with PE were older, had longer hospital stays, greater severity of illness, and higher mortality rates. Notably, SCD patients with PE underwent fewer chest computed tomography scans than their non-SCD counterparts, suggesting potential underdiagnosis in this high-risk population [12].

Thrombosis is acknowledged as a complication of sickle cell trait, with evidence of ongoing coagulation and platelet activation even outside of crisis episodes. However, the rates of thrombosis in sickle cell disease (SCD) are not well-established. In a study involving hospitalized SCD patients, the prevalence of pulmonary embolism (PE) was found to be 3.5 times higher compared to age-matched non-SCD African-Americans, although there was no increased prevalence of deep venous thrombosis (DVT) [13-14].

Among hospitalized patients, pulmonary embolism (PE) contributes to 10% of deaths. Prophylactic anticoagulation guidelines have been recommended for PE management. However, the impact of anticoagulation on health outcomes in sickle cell disease (SCD) patients, who are frequently hospitalized, remains inadequately studied. Prophylactic

anticoagulation is not routinely prescribed for hospitalized SCD patients [15].

4. CONCLUSION

The simultaneous occurrence of acute coronary syndrome (ACS) and pulmonary embolism (PE) in a young woman with sickle cell disease (SCD) highlights the complex and challenging nature of managing cardiovascular complications in this population. The case underscores the need for heightened clinical awareness, early recognition, and tailored management strategies to improve outcomes and reduce mortality in SCD patients experiencing acute cardiovascular events.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

CONSENT

As per international standards or university standards, patient(s) written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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