

# ST-Segment Elevation Myocardial Infarction with Extensive Coronary Thrombus in a Patient with Sickle Cell Anemia

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## ABSTRACT

Myocardial infarction in patients with sickle cell anemia is often underdiagnosed due to confounding factors (e.g., vaso-occlusive disease leading to painful crisis). In the majority of reported cases, the coronary arteries were pervious and without stenotic lesions. In this case report, we describe the presence of an extensive coronary thrombus in a patient with sickle cell anemia presenting with ST elevation myocardial infarction, managed satisfactorily with the association of anticoagulants and antiplatelet drugs.

**DESCRIPTORS:** Anemia, sickle cell. Myocardial infarction. Anticoagulants. Cardiac catheterization.

Sickle cell anemia is an inherited hemoglobinopathy attributed to a specific molecular lesion resulting in hemoglobin polymerization into long fibers, forming a gel, which makes red blood cells stiff and sickle-shaped, reducing their flexibility and hindering their passage through microcirculation.<sup>1</sup>

The occurrence of acute myocardial infarction (AMI) in patients with sickle cell anemia is often underdiagnosed, due to confounding factors (e.g., vaso-occlusive disease leading to painful crises, such as bone pain). However, in most reported cases, the coronary arteries were patent and showed no lesions.<sup>2</sup> In this case report, the authors describe the occurrence of AMI with ST-segment elevation and extensive coronary thrombus in

## RESUMO

### Infarto com Supradesnívelamento do Segmento ST e Trombo Coronariano Extenso em Paciente com Anemia Falciforme

O infarto agudo do miocárdio em pacientes com anemia falciforme é, muitas vezes, subdiagnosticado em virtude de fatores de confusão (por exemplo, doença vaso-occlusiva, levando a crises dolorosas). Na maioria dos casos relatados na literatura, as artérias coronárias estavam pÉrvias e sem lesões. Neste relato de caso, descrevemos a presença de trombo coronariano extenso em paciente com anemia falciforme, apresentando-se sob a forma de infarto agudo do miocárdio com supradesnívelamento do segmento ST, manejado satisfatoriamente com a associação de anticoagulantes e antiplaquetários.

**DESCRITORES:** Anemia falciforme. Infarto do miocárdio. Anticoagulantes. Cateterismo cardíaco.

a patient with sickle cell anemia, discussing therapeutic approaches for this situation.

## CASE REPORT

Male patient, 48 years old, smoker and alcohol consumer, with diagnoses of arterial hypertension and sickle cell anemia (SS hemoglobinopathy, last painful crisis 4 years prior), using enalapril and hydroxyurea. He sought emergency care complaining of intense retrosternal pain, radiating to the jaw and left arm, which had started one hour before, associated with sweating.

On admission, the electrocardiogram (ECG) showed ST-segment elevation in the inferior leads (Figure 1) and

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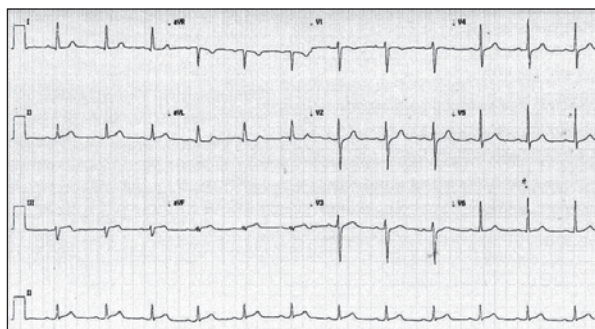
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the patient was referred for invasive stratification, after receiving acetylsalicylic acid (ASA) and clopidogrel. He did not have signs of pulmonary congestion and was hemodynamically stable (Killip I).

The coronary angiography showed dominant right coronary artery, with an image suggestive of thrombus presence in the proximal segment, with Thrombolysis in Myocardial Infarction (TIMI 3) distal flow and non-stenotic lesions, and the other vessels were free of significant stenosis (Figure 2). Due to the fact that the patient was hemodynamically stable with preserved distal flow, and also that he was a low-risk patient for bleeding as estimated by the CRUSADE score (22 points, hospital risk 5.5%), it was decided not to perform a percutaneous intervention at that time; abciximab was administered and anticoagulation was maintained with unfractionated heparin administered by infusion pump (anticoagulant initially used in cardiac catheterization), as well as the concomitant use of ASA and clopidogrel, with repeat catheterization planned for 48 to 96 hours later.

ECG prior to the new catheterization (Figure 3) showed primary repolarization alterations in the inferior wall, with complete regression of ST-segment elevation.



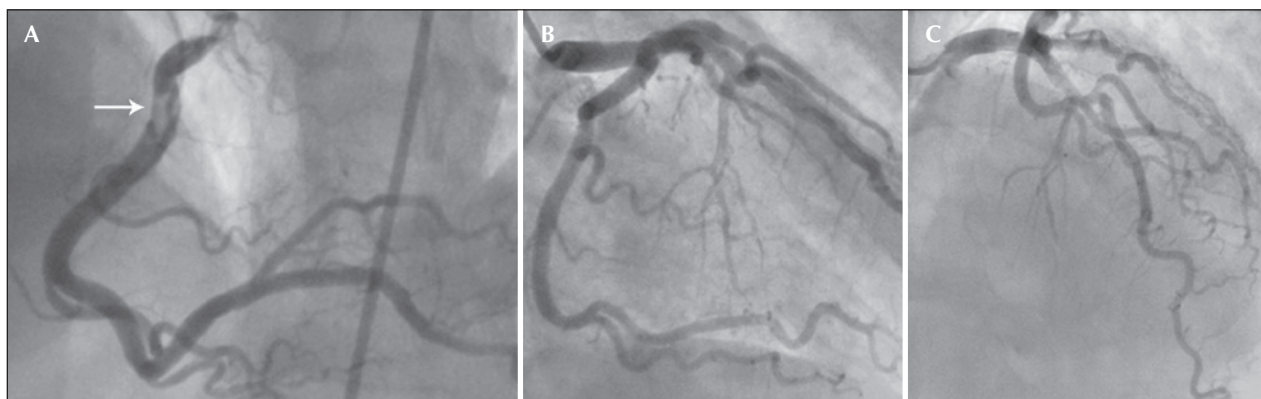
**Figure 1** – Admission electrocardiogram: 1 mm ST-segment elevation in DIII and AVF leads.

The patient remained clinically stable and was submitted to a new catheterization four days later, which persisted showing an image compatible with thrombus presence in the right coronary artery proximal segment, but smaller in size, when compared to the prior assessment, with no residual stenosis and TIMI-3 distal flow (Figure 4). The echocardiography showed preserved left ventricular global and segmental systolic functions with ejection fraction of 72%. In order to rule out the association with Moyamoya syndrome, a cerebrovascular alteration eventually observed in patients with sickle cell anemia that greatly increases the risk of intracranial bleeding in these individuals, whose presence could influence the anticoagulation strategy after discharge, the patient underwent a cerebral angiography, which excluded such diagnosis. He showed clinical improvement and was discharged with a prescription for ASA, clopidogrel, warfarin, and simvastatin.

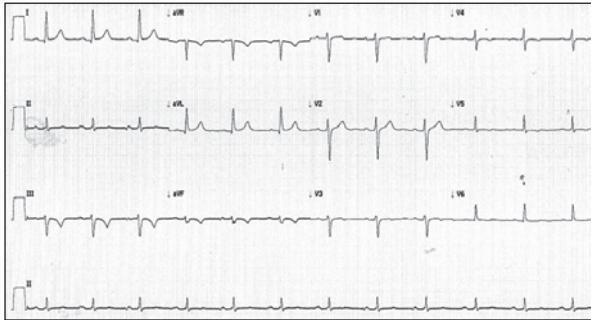
## DISCUSSION

Myocardial ischemia and infarction should be considered in patients with sickle cell anemia and chest pain. Case reports of patient's with acute chest crisis have shown ECG alterations, troponin increase suggestive of AMI, myocardial perfusion defects in nuclear medicine assessment, and cardiac magnetic resonance imaging (MRI) abnormalities. These findings have been attributed to acute and chronic microvascular occlusion, in the context of chronic endothelial damage, procoagulant state, and systemic vascular disease. The risk stratification of these patients should primarily consider the existence of associated medical conditions, such as worsening anemia, hypoxia, *cor pulmonale*, renal failure, infection, and acidosis. Cardiac abnormalities have been reverted after exchange transfusion and aggressive support for ischemia.

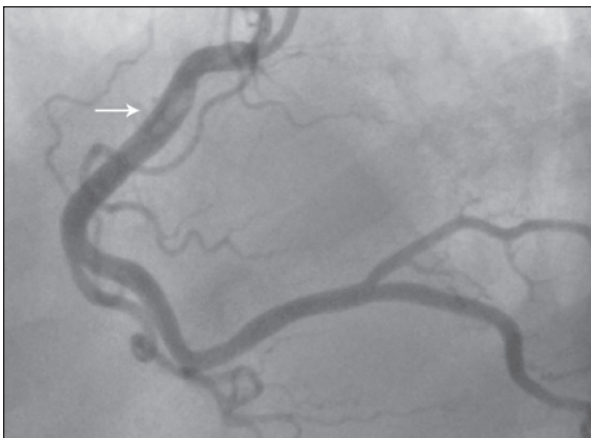
The coronary angiography shows normal coronary arteries in most cases, which contravenes its routine use,



**Figure 2** – Coronary angiography in the left anterior oblique view, showing extensive thrombus in the proximal segment of the right coronary artery, free of stenotic lesions (A). Caudal (B) and cranial right anterior oblique view (C), respectively, showing the left anterior descending and left circumflex coronary arteries free of lesions.



**Figure 3** – Electrocardiogram 4 days later, before the new catheterization, with complete regression of ST elevation and T-wave inversion in DIII and aVF leads.



**Figure 4** – New coronary angiography, at the same view as the previous one, demonstrating thrombus reduction in the proximal segment of the right coronary artery.

especially in patients with sickle anemia and chest pain with a low-risk profile. However, patients with sickle cell anemia and chest pain with suspected myocardial ischemia (as in the present case) should be admitted to a cardiac unit for monitoring, and other associated medical conditions should be promptly managed, together with hydration and oxygenation. In this case, the coronary angiography showed extensive thrombotic burden and the patient's risk profile (smoker) probably contributed to this finding. As the flow in the affected artery was TIMI 3 at the time of the study and due to the low risk of bleeding events, it was decided to use a strategy without coronary stenting, with aggressive anticoagulation and antiplatelet therapy. However, to support such strategy, further studies in patients with sickle cell anemia are necessary, aiming to assess the effect of antiplatelet agents, blood transfusions, and other conventional therapies for ischemic heart disease.<sup>2,3</sup>

In patients with acute coronary syndrome, the presence of extensive intracoronary thrombus increases

the risk of distal embolization, abrupt occlusion, stent thrombosis, need for a new revascularization, myocardial infarction, and death.<sup>4</sup> Moreover, the occurrence of TIMI flow  $\leq 1$ , with no signs of distal occlusion or embolization of the treated artery (no-reflow), is considered an independent predictor of myocardial infarction and post-procedure death.<sup>5</sup> Antithrombotic and antiplatelet therapies can reduce the thrombotic burden, and embolic protection devices and thrombectomy can remove thrombus fractions. However, the effectiveness of these measures is often not ideal, and the adequate treatment of extensive coronary thrombi remains a poorly defined problem, often faced during percutaneous coronary intervention. In AMI with ST-segment elevation with the presence of extensive thrombus, the risk/benefit of performing *ad-hoc* angioplasty in clinically-stable patients without an urgent need for revascularization is not well defined. A study comparing the immediate percutaneous coronary intervention with the late intervention, in this context, after intensive antithrombotic therapy (glycoprotein IIb/IIIa inhibitors, enoxaparin, ASA, and clopidogrel) for  $60.0 \pm 30.8$  hours, observed that this strategy was safe and associated with a reduction in the thrombotic burden, angiographic complications, and need for revascularization; such benefits were observed without an increase in the occurrence of hemorrhagic complications.<sup>5</sup> This approach was similar to that used in this case.

However, there are conflicting reports about antiplatelet therapy in sickle cell disease, particularly regarding the effect of ASA. A limitation of these studies is that the *in vivo* effect of the drugs on platelet activation was often not assessed; it is possible that antiplatelet therapy, at a sufficient dose to inhibit platelet activation, has beneficial effects on vaso-occlusive complications. Studies using warfarin are also controversial.<sup>6</sup>

Moyamoya syndrome, investigated and ruled out in this case, is a cerebrovascular disease that predisposes affected patients to the occurrence of stroke due to progressive stenosis of the distal portions of intracranial internal carotid arteries and their branches. The reduced blood flow in the large vessels of anterior brain circulation leads to the development of collateral circulation, with the formation of small vessels. It can be idiopathic (Moyamoya disease) or the result of a specific underlying disease, such as atherosclerosis and sickle cell anemia, or radiotherapy (Moyamoya syndrome). Antiplatelet agents have been used to prevent microthrombus embolization at the sites of arterial stenosis and these drugs, although not universally used, are routinely used in patients in many series. Anticoagulants such as warfarin are rarely used.<sup>7</sup> In this case, the exclusion of this syndrome allowed for anticoagulation, which would be otherwise contraindicated due to the potential risk of hemorrhagic stroke.

## CONCLUSIONS

In patients with acute coronary syndrome associated with sickle-cell anemia, in the presence of high thrombotic burden, an approach with aggressive anticoagulation and antiplatelet therapy can be a successful strategy, as in this case. A larger sample is required for reproduction and confirmation of the satisfactory results obtained with this approach. In the case reported, it was decided to maintain ASA and clopidogrel at discharge, as well as oral anticoagulation with warfarin, indefinitely.

## CONFLICTS OF INTERESTS

The authors declare no conflicts of interest.

## FUNDING SOURCES

None declared.

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