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Acute myocardial infarction related to atrial fibrillation

Anil Batta[1], Anindita Mondal[2]
[1] HOD, Professor, Department of Biochemistry, Muzaffarnagar Medical college, Muzaffarnagar, Uttar Pradesh, India
[2] Department of Pathology, Muzaffarnagar Medical College, Muzaffarnagar, Uttar Pradesh, India

Abstract
Atrial fibrillation increases the risk of stroke fivefold, while other systemic embolisms are less common. The incidence of myocardial infarction due to coronary embolism ranges between 4-5%. Atrial fibrillation related coronary embolism remains an underappreciated cause of acute coronary syndromes. We present the case of a 66-year-old male with well-controlled hypertension and untreated atrial fibrillation. He arrived at the emergency department with acute chest pain, which was diagnosed as an inferior myocardial infarction. Coronary angiography revealed a high thrombotic burden in the right coronary artery without any underlying atherosclerosis. The patient was treated with antithrombotic therapy, and a follow-up coronary angiography 48 hours later showed satisfactory results. He was counseled on the importance of adherence to treatment and the need for long-term follow-up.

Keywords: Atrial fibrillation, coronary embolism, myocardial infarction, thrombotic burden, antithrombotic therapy

Introduction

Atrial fibrillation is the most common sustained arrhythmia in the global population. It is associated with a fivefold increase in stroke risk and a higher rate of hospitalizations. [1] The management of atrial fibrillation primarily focuses on rhythm or rate control and addressing cardiovascular risk factors. While cerebral emboli are the most frequent complication of Atrial fibrillation, other systemic emboli account for less than 11% of cases. [2] Atrial fibrillation can result from myocardial ischemia, and conversely, atrial fibrillation can lead to myocardial infarction. The incidence of myocardial infarction of embolic origin is between 4-5%, and in one-third of cases, the embolus is attributed to atrial fibrillation. [3, 4] The diagnosis is suspected when there is intracoronary thrombus burden without significant underlying atherosclerotic disease. Given its rarity, determining the risk factors for coronary emboli related to atrial fibrillation is challenging. We report a case of myocardial infarction associated with coronary emboli in a patient who was untreated for atrial fibrillation. This highlights the importance of appropriate management of Atrial fibrillation to prevent both cerebrovascular and cardiovascular complications.

Case report

We report the case of a 66-year-old patient with well-controlled hypertension under treatment, who has been followed for atrial fibrillation for six years (CHADSVASC = 2). The patient discontinued anticoagulant therapy one year ago. He presented to the emergency department two hours after the onset of typical infarct-like acute chest pain, accompanied by nausea and vomiting, without any history of syncope or fainting.

Upon admission, the clinical examination revealed a hemodynamically stable but still suffering patient. The cardiovascular examination was unremarkable. An electrogram performed in the emergency department (figure 1) showed atrial fibrillation with a slow ventricular rate of 66 bpm, ST-segment elevation in the inferior leads, and Q waves in lead III.

A chest X-ray was normal, and bedside echocardiography revealed hypokinesia of the inferior wall with preserved systolic function and no associated mitral regurgitation. After blood samples were taken, the patient was immediately admitted to the catheterization lab. Coronary angiography (figure 2) revealed an acute thrombotic occlusion of the mid-right coronary artery. The decision was made to manage the patient medically with unfractionated heparin, tirofiban, and antiplatelet agents. A follow-up angiogram performed 48 hours later showed satisfactory results and restoration of coronary flow. Additionally, there was mild atherosclerotic burden without significant coronary lesions.

Blood tests revealed troponin levels 200 times the normal value and abnormal lipid profile results. The patient was discharged on medical therapy, including clopidogrel, rivaroxaban, and statins. He was thoroughly educated on the importance of adherence to treatment and the necessity of regular follow-up.

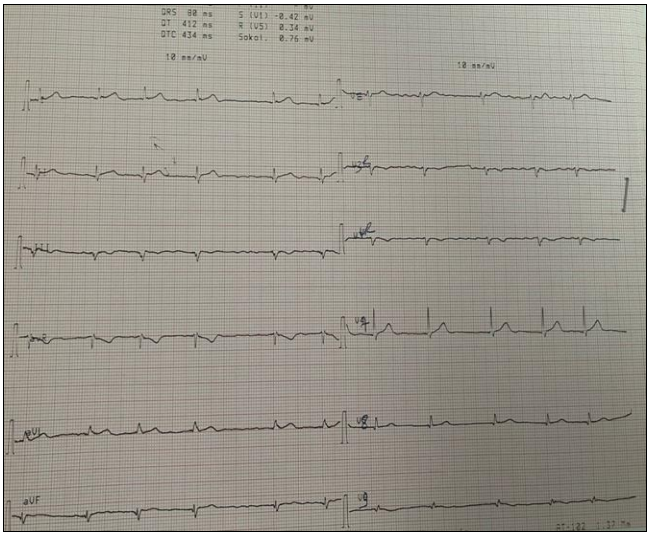

Fig 1 : electrogram up on admission

Fig 2: coronary angiography showing an acute occlusion of right coronary artery

Discussion

The prevalence of AF is estimated to be 1-2% in the general adult population, increasing to 9-17% in individuals over 90 years old (5–7). This condition is increasingly common due to improved life expectancy and an aging population [8]. The incidence of atrial fibrillation in acute coronary syndromes (ACS) is estimated between 2-23% [9]. Atrial fibrillation increases the risk of myocardial ischemia and is often associated with other cardiovascular risk factors.

Atrial fibrillation worsens and perpetuates structural and electrophysiological changes, leading to atrial cardiomyopathy, it promotes blood stasis, significantly elevating the risk of thromboembolic complications, such as stroke [10].

Embolic events are often described in the cerebral territory and more rarely in the coronary arteries, which are relatively protected by the hemodynamic characteristics of systemic circulation. The narrow lumen of the coronary arteries, the differences in resistance compared to the aorta, the diastolic perfusion of the coronary arteries, and the anatomical location of the coronary ostia, along with the acute angle of their origin in the aortic sinuses, favor flow in the aorta and decrease the risk of coronary emboli [11]

Despite the differences in pathophysiology, the clinical presentation of STEMI is often indistinguishable between embolic and atherosclerotic causes. Both conditions present with typical chest pain, ST-segment elevation on electrocardiogram, and elevated cardiac biomarkers. Autopsy results have shown that myocardial infarctions (MI) secondary to atrial fibrillation (AF) are often linked to distal embolization of the coronary arteries, leading to transmural infarctions [12].

Patients experiencing coronary emboli tend to be younger, typically aged between 63 and 73 years, which aligns with the case of the patient in question. The primary risk factors associated with coronary embolism include hypertension and diabetes. [13, 14]

A case series indicates that 73% of patients admitted for embolic MI had a history of atrial fibrillation (A24), and that nearly 2% of atrial fibrillation cases are complicated by coronary embolism [13, 15]

A scoring system (table 1) categorizing coronary embolism into definite and probable based on specific clinical and angiographic criteria was proposed by Shibata *et al* [16] According to this score, our case qualifies as a definite coronary embolism.

However, a study [4] evaluating the usefulness of Shibata's criteria for diagnosing embolic STEMI showed that while the criteria exhibit good sensitivity, they lack specificity. This suggests that while the criteria can effectively identify cases of embolic origin, they may also misclassify some cases, leading to potential overdiagnosis in certain contexts [17].

Myocardial infarction caused by coronary emboli is associated with a higher mortality rate, nearly 50% at 10 years [18] The risk of recurrent embolism is 10% in the series by Shibata *et al* [16]

The management of coronary embolism remains complex. Differentiating between coronary emboli and thrombi associated with atherosclerotic plaques can be achieved using intravascular imaging, although this technique is not commonly utilized in clinical practice.

In the acute phase of treatment, it's important to note that red thrombi—which are typically formed in the setting of atrial fibrillation—are generally resistant to fibrinolysis due to their low fibrin content. Consequently, the routine use of thrombus aspiration [19] has fallen out of favor, as it has been associated with an increased risk of stroke following coronary angiography. The primary potential benefit of thrombus aspiration may lie in confirming the embolic origin of the infarction and facilitating the study of the thrombus's nature.

After managing the acute coronary syndrome, further investigation of the embolic source is crucial. Transthoracic and transesophageal echocardiography are essential for visualizing the left atrium and identifying potential sources of emboli, such as thrombi in the left atrial appendage.

Long-term anticoagulation therapy is mandatory for patients with coronary embolism, regardless of their CHADS2-VASC score, due to the high risk of recurrent embolism. However, careful consideration of the hemorrhagic risk associated with anticoagulation is necessary to balance the benefits and potential complications of treatment.

Table 1: Scoring System for Diagnosis of Coronary Embolus (16)

Major criteria
▪ Angiographic evidence of coronary embolus/thrombus (e.g., a filling defect, or abrupt occlusion in an artery without significant atherosclerosis)
▪ Concomitant coronary emboli in multiple coronary vascular territories
▪ Concomitant systemic embolization without left ventricular thrombus attributable to acute myocardial infarction
▪ Histological evidence of venous origin of coronary embolic material
▪ Evidence of an embolic source based on TTE, TEE, CT, or MRI (e.g., clot in left atrial appendage)
Minor criteria
▪ <25% stenosis on angiography in the nonculprit vessels
▪ Atrial fibrillation
▪ Presence of embolic risk factors, cardiomyopathy, rheumatic heart disease, prosthetic valve, PFO, ASD, history of cardiac surgery, infective endocarditis, or hypercoagulable state
Patients with 2 or more major criteria, 1 major and 2 minor, or 3 minor criteria were considered to have a definite coronary embolus. Patients with 1 major and 1 minor or 2 minor criteria were considered to have a probable coronary embolus.

Conclusion

The causal relationship between myocardial ischemia and atrial fibrillation (AFib) is well established. However, coronary emboli remain an underappreciated cause of acute coronary syndromes. Patients experiencing this complication are typically at high cardiovascular risk and often present with multiple comorbidities, leaving their long-term prognosis uncertain. This underscores the critical need for screening for atrial fibrillation, especially paroxysmal AFib, which may be more challenging to detect. The factors that contribute to the formation of coronary emboli in patients with atrial fibrillation are not yet fully understood. It is essential for these patients to be educated about the importance of anticoagulant therapy and the necessity of long-term follow-up, given the high risk of recurrence associated with AFib.

The management of MI due to coronary emboli poses significant challenges, necessitating a multifaceted approach that includes accurate diagnosis, appropriate acute management, and long-term anticoagulation strategies to mitigate the risk of recurrent events.

Abbreviations

ASD: atrial septal defect
CT: computerized tomography
MRI: magnetic resonance imaging
PFO: patent foramen ovale
TEE: transesophageal echo- cardiography
TTE: transthoracic echocardiography.

Refrences

1. Sanders GD, Lowenstern A, Borre E, Chatterjee R, Goode A, Sharan L, *et al*. Stroke Prevention in Patients with Atrial Fibrillation: A Systematic Review Update [Internet]. Agency for Healthcare Resarch and Quality (AHRQ); oct [cité 20 août 2024]. Disponible sur, 2018. https://effectivehealthcare.ahrq.gov/topics/stroke-afib-update/research-2018
2. Tzeis S, Gerstenfeld EP, Kalman J, Saad EB, Sepehri Shamloo A, Andrade JG, *et al*. European Heart Rhythm Association/Heart Rhythm Society/Asia Pacific Heart Rhythm Society/Latin American Heart Rhythm Society expert consensus statement on catheter and surgical ablation of atrial fibrillation. EP Eur. avr,2024:26(4):143.
3. Lloyd-Jones DM, Wang TJ, Leip EP, Larson MG, Levy D, Vasan RS, *et al*. Lifetime risk for development of atrial fibrillation: the Framingham Heart Study. Circulation,2004:110(9):1042-6.
4. Balogh L, Óvári P, Ugbodaga CU, Csanádi Z. Atrial Fibrillation Related Coronary Embolism: Diagnosis in the Focus. J Pers Med,2023:13(5):780.
5. Nantsupawat T, Nugent K, Phrommintikul A. Atrial fibrillation in the elderly. Drugs Aging. Août,2013:30(8):593-601.
6. Kornej J, Börschel C, Benjamin EJ, Schnabel RB. Epidemiology of Atrial Fibrillation in the 21st Century, Novel Methods and New Insights. Circ Res. 19 juin,2020:127(1):4-20.
7. Abumuaileq' 'Rami Riziq Yousef. Atrial fibrillation in the old/very old: prevalence and burden, predisposing factors and complications [Internet].17. [Cité 20 août 2024]. Disponible sur : https://www.escardio.org/Journals/E-Journal-of-Cardiology-Practice/Volume-17/Atrial-fibrillation-in-the-old-very-old-prevalence-and-burden-predisposing-factors-and-complications, https://www.escardio.org/Journals/E-Journal-of-Cardiology-Practice/Volume-17/Atrial-fibrillation-in-the-old-very-old-prevalence-and-burden-predisposing-factors-and-complications
8. Lippi G, Sanchis-Gomar F, Cervellin G. Global epidemiology of atrial fibrillation: An increasing epidemic and public health challenge. Int J Stroke Off J Int Stroke Soc. Févr,2021:16(2):217-21.
9. Hindricks G, Potpara T, Dagres N, Arbelo E, Bax JJ, Blomström-Lundqvist C, *et al*. ESC Guidelines for the diagnosis and management of atrial fibrillation developed in collaboration with the European Association for Cardio-Thoracic Surgery (EACTS). Eur Heart J. 1 févr,2021:42(5):373-498.
10. Baman JR, Cox JL, McCarthy PM, Kim D, Patel RB, Passman RS, *et al*. Atrial fibrillation and atrial cardiomyopathies. J Cardiovasc Electrophysiol. Oct,2021:32(10):2845-53.
11. Soliman EZ, Safford MM, Muntner P, Khodneva Y, Dawood FZ, Zakai NA, *et al*. Atrial fibrillation and the risk of myocardial infarction. JAMA Intern Med. Janv,2014:174(1):107-14.
12. Prizel KR, Hutchins GM, Bulkley BH. Coronary artery embolism and myocardial infarction. Ann Intern Med. Févr,1978:88(2):155-61.
13. Daoud H, Abugroun A, Erramilli S, Kumar S. Acute Coronary Syndrome (ACS) due to Coronary Artery Embolism in a Patient with Atrial Fibrillation. Case Rep Cardiol. 10 oct,2019:2019:9347198.
14. Lacey MJ, Raza S, Rehman H, Puri R, Bhatt DL, Kalra A. Coronary Embolism: A Systematic Review. Cardiovasc Revascularization Med Mol Interv. Mars,2020:21(3):367-74.
15. Popovic B, Agrinier N, Bouchahda N, Pinelli S, Maigrat CH, Metzdorf PA, *et al*. Coronary Embolism Among ST-Segment–Elevation Myocardial Infarction Patients. Circ Cardiovasc Interv. Janv,2018:11(1):5587.
16. Shibata T, Kawakami S, Noguchi T, Tanaka T, Asaumi Y, Kanaya T, *et al*. Prevalence, Clinical Features, and Prognosis of Acute Myocardial Infarction Attributable to Coronary Artery Embolism. Circulation. 28 juill,2015:132(4):241-50.
17. Monin A, Didier R, Leclercq T, Chagué F, Rochette L, Danchin N, *et al*. Coronary artery embolism and acute coronary syndrome: A critical appraisal of existing data. Trends Cardiovasc Med. Janv,2024:34(1):50-6.
18. Piccolo R, Oliva A, Avvedimento M, Franzone A, Windecker S, Valgimigli M, *et al*. Mortality after bleeding versus myocardial infarction in coronary artery disease: a systematic review and meta-analysis [Internet]. [cité 20 août 2024]. Disponible sur: https://eurointervention.pcronline.com/article/mortality-after-bleeding-versus-myocardial-infarction-in-coronary-artery-disease-a-systematic-review-and-meta-analysis
19. Kumar D, Patra S, Pande A, Chakraborty R, Mukherjee SS, Roy RR, *et al*. Long-term clinical outcomes of thrombus aspiration in STEMI patients undergoing

primary percutaneous coronary intervention. Am J Cardiovasc Dis. 15 juin,2020 :10(2):117-23.