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Severe Heart Failure In A Young Smoker: Interaction Between Substance Abuse, Infection, And Coronary Artery Disease

Z.Amine ; M.Amri ; M.Haboub ;A.Drighil ;R.Habbal .

Cardiology Department ,IBN Rochd Hospital ,Casablanca,Morocco.

Abstract:

Heart failure in young adults is rare and often multifactorial. We report a case of a 39-year-old man, an active smoker and cannabis user, admitted for de novo global heart failure following a recent flu-like illness. He presented with severe systolic dysfunction (LVEF 10%) and a left ventricular thrombus. Coronary angiography revealed unexpected multi-vessel coronary artery disease. This case highlights the role of smoking, cannabis use, and systemic inflammation in accelerating cardiovascular damage. Management included anticoagulation, heart failure therapy, and planned revascularization. Secondary prevention, including smoking cessation and long-term follow-up, is crucial to improving prognosis.

Introduction

Heart failure in young adults is a rare event, often linked to structural heart diseases, infections, or toxic exposures. Substance abuse, including tobacco and cannabis, is recognized as a risk factor for cardiovascular conditions such as myocardial infarction and heart failure. This case report describes a 39-year-old patient with severe de novo heart failure associated with significant coronary artery disease in the context of active smoking, cannabis use, and a recent flu-like illness.

Case Presentation

A 39-year-old man, active smoker, and cannabis user, followed for depression and under treatment, was admitted for de novo global heart failure. He reported progressive dyspnea, orthopnea, fatigue, and lower limb edema evolving over one week. He also mentioned flu-like symptoms, including fever and myalgia, occurring two weeks before admission.

On clinical examination, the patient showed signs of global heart failure, including jugular vein distension, bilateral crackles at the pulmonary bases, ascites, and peripheral edema. His blood pressure was 90/60 mmHg, heart rate 110 bpm, and oxygen saturation 88% on room air. The electrocardiogram revealed sinus tachycardia at 110 bpm, an incomplete right bundle branch block (RBBB), and a notched QRS pattern in inferior leads. Cardiac biomarkers were elevated, with troponin at 1172 ng/L, indicating acute myocardial injury.

Transthoracic echocardiography showed a severely reduced left ventricular ejection fraction (LVEF) of 10%, a large thrombus lining the left ventricular apex, and global hypokinesia. Emergency coronary angiography revealed significant stenosis in the middle and distal segments of the left anterior descending artery (LAD), occlusion of the left circumflex artery, and severe stenosis in the distal right coronary artery. These findings were consistent with multi-vessel coronary artery disease.

Initial treatment included anticoagulation for the ventricular thrombus, initiation of optimized medical therapy for heart failure (beta-blockers, ACE inhibitors, diuretics), and a discussion regarding revascularization options. The clinical course showed improvement under treatment, with a plan for subsequent interventional management.

Discussion :

Acute de novo heart failure in a young adult is a rare clinical event that is often multifactorial. This particular case highlights the complex interplay between several contributing factors, including substance abuse, a recent infection likely causing myocarditis, and unusual multi-vessel coronary involvement for this age group. These elements require in-depth analysis to better understand their role in the pathophysiology and their impact on management.

1. The Role of Tobacco and Cannabis in Cardiovascular Diseases

Smoking is a well-established risk factor for cardiovascular diseases, particularly coronary artery disease. Nicotine, the active component of tobacco, induces acute vasoconstriction, exacerbates oxidative stress, and impairs endothelial function. These mechanisms contribute to the progression of atherosclerosis and significantly increase the risk of acute coronary events. A meta-analysis by Ambrose and Barua (2004) demonstrated that smokers have a relative risk of 2.87 for cardiovascular diseases compared to non-smokers.

Cannabis use, although less studied, also raises growing concerns in the cardiovascular domain. Available studies suggest that cannabis can provoke coronary vasospasms and pro-thrombotic effects by interfering with the endocannabinoid system. These mechanisms promote cardiovascular instability, especially in young adults. A recent study by Singh et al. (2022) showed that cannabis users have an increased risk of acute coronary syndrome, even in the absence of other major risk factors. When combined, tobacco and cannabis may act synergistically, exacerbating cardiovascular damage and accelerating the development of atherosclerosis.

2. Recent Infection and Suspected Myocarditis

The clinical presentation suggests viral myocarditis occurring in the context of a recent flu-like illness. Viral infections, including influenza, can cause direct myocardial injury, leading to myocardial inflammation, systolic dysfunction, and cardiomyocyte necrosis. These mechanisms can result in acute heart failure, particularly in younger individuals.

In this case, however, the diagnosis of myocarditis is based on clinical and echocardiographic findings, as confirmatory tests like cardiac magnetic resonance imaging (MRI) or endomyocardial biopsy were not performed. Cardiac MRI remains the gold standard for identifying myocardial inflammation (e.g., edema, hyperemia, or fibrosis), as noted by Friedrich et al. (2009). ` While the absence of such diagnostic confirmation limits certainty, the clinical characteristics, post-viral context, and echocardiographic findings (marked systolic dysfunction) strongly support this hypothesis.

3. Multi-Vessel Coronary Disease in a Young Adult

Coronary angiography revealed significant stenoses in multiple coronary arteries, which is unusual in a young adult without major metabolic comorbidities. This finding may be attributed to an interplay of several risk factors, including smoking, cannabis use, and systemic inflammation associated with a recent infection.

Studies suggest that systemic inflammation can accelerate atherosclerotic processes by promoting the formation and rupture of unstable plaques. In this case, it is possible that inflammation associated with post-viral myocarditis exacerbated pre-existing coronary lesions, triggering myocardial ischemia.

4. Formation of an Intraventricular Mural Thrombus

The presence of a mural thrombus at the apex of the left ventricle represents a serious but well-recognized complication in cases of severe heart failure and systolic dysfunction. This thrombus is facilitated by Virchow's triad: (1) blood stasis due to reduced ejection fraction, (2) endothelial injury caused by myocardial inflammation or ischemia, and (3) hypercoagulability, likely induced by systemic inflammation and pro-thrombotic states.

In this context, prompt therapeutic anticoagulation was initiated to reduce the risk of systemic embolization, in line with AHA guidelines (Roffi et al., 2016). This step is critical in managing such patients, as embolization can lead to severe neurological or systemic complications.

5. Therapeutic Strategies and Practical Implications

Management focused on three main aspects: optimizing cardiac function, preventing thromboembolic complications, and planning a revascularization strategy.

Initially, foundational therapies for heart failure (ACE inhibitors, beta-blockers, and diuretics) were introduced with gradual titration to improve hemodynamics and reduce volume overload. Therapeutic anticoagulation was essential to prevent systemic embolism from the mural thrombus.

Finally, myocardial revascularization will be considered after clinical stabilization. Either percutaneous coronary intervention (angioplasty) or coronary artery bypass grafting will be chosen based on the characteristics of the coronary lesions and the patient's overall condition.

6. Secondary Prevention and Long-Term Follow-Up

This case highlights the need for rigorous secondary prevention to reduce the risk of recurrence. Smoking and cannabis cessation is an absolute priority, requiring psychological support and potentially addiction treatment. Lifestyle modifications, including a balanced diet, appropriate physical activity, and the control of metabolic risk factors (lipids, blood glucose), should be integrated into care.

Close follow-up with echocardiography will help assess the recovery of left ventricular function. Additionally, the use of inflammatory and cardiac biomarkers can guide therapeutic adjustments. The primary goal is to optimize cardiac function while minimizing the risk of future cardiovascular events.

Conclusion

This case illustrates the complexity of acute de novo heart failure in a young adult, where behavioral, infectious, and cardiovascular risk factors intersect. Management requires a multidisciplinary approach combining clinical stabilization, prevention of complications, and early intervention on modifiable risk factors. An individualized strategy and long-term follow-up are essential to improving the prognosis for such patients.

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