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Exploring the Shifting Paradigms in Acute Myocarditis Diagnosis and Care

Miriam Cohen*

Department of Cardiac Thoracic Vascular Sciences and Public Health, University of Padova, 35-100 Padova, Italy

Introduction

Acute myocarditis is an inflammatory disease of the heart muscle, typically caused by viral infections, autoimmune reactions, or exposure to toxins. It presents a significant challenge in clinical practice due to its variable etiology, ranging from mild symptoms to life-threatening conditions like heart failure and arrhythmias. Historically, myocarditis was difficult to diagnose due to its nonspecific symptoms, leading to frequent misdiagnosis or underdiagnosis. However, over the past few decades, there have been significant shifts in how the disease is both diagnosed and treated. Technological advancements, particularly in imaging and biomarker identification, along with the growing understanding of its molecular mechanisms, have reshaped clinical practices. Today, the management of acute myocarditis is multifaceted, often involving a combination of supportive therapies, targeted medications and, in severe cases, mechanical circulatory support or heart transplantation. This essay explores the shifting paradigms in the diagnosis and management of acute myocarditis, examining the evolution of clinical practices, the role of innovative diagnostic tools and contemporary treatment strategies [1].

Description

The diagnosis of acute myocarditis has evolved significantly from its early descriptions in the 19th century, when the condition was often misdiagnosed due to a lack of understanding and limited diagnostic tools. Early diagnostic methods primarily relied on clinical symptoms, with many cases only identified at autopsy. With the introduction of Electro Cardio Graphy (ECG) in the 1920s, clinicians could assess the electrical activity of the heart, identifying abnormalities suggestive of myocardial involvement. However, ECG findings alone were often not sufficient to definitively diagnose myocarditis, as the symptoms could be indistinguishable from those of other cardiac conditions. The introduction of echocardiography in the 1950s allowed for real-time imaging of the heart's structures, helping clinicians visualize heart function and detect signs of myocardial damage, although this tool had limitations in detecting subtle myocardial inflammation [2].

The real breakthrough in the non-invasive diagnosis of acute myocarditis came with the advent of Cardiac Magnetic Resonance Imaging (CMR) in the 1980s. This imaging technique enabled detailed visualization of myocardial inflammation, edema and fibrosis, allowing for a more accurate diagnosis. In 2018, the Lake Louise Criteria were established, providing a standardized approach to interpreting CMR findings and improving diagnostic accuracy. CMR now plays a central role in diagnosing myocarditis, especially as it can detect abnormalities even in the absence of overt symptoms. Biomarkers, such as cardiac troponins and B-Type Natriuretic Peptide (BNP), have further refined diagnosis by indicating myocardial injury and heart failure. Elevated cardiac troponins are commonly used to confirm myocardial injury, while BNP levels can help assess the severity of heart failure in patients with myocarditis [3].

Despite the advancements in diagnostic tools, Endo Myocardial Biopsy (EMB) remains the gold standard for confirming myocarditis, particularly when the diagnosis is uncertain. EMB involves taking a small sample of heart tissue for histological examination to identify inflammatory cells, viral genomes, or autoimmune markers. Although EMB is highly accurate, it is an invasive procedure with potential risks such as bleeding or infection and its use is often limited to cases where non-invasive tests are inconclusive. In terms of management, the treatment of acute myocarditis has undergone a significant transformation. In the past, treatment was largely supportive, focused on managing symptoms such as heart failure with medications like diuretics, Angiotensin-Converting Enzyme (ACE) inhibitors and beta-blockers. These medications help reduce the strain on the heart by improving its pumping ability and managing fluid retention. As understanding of the disease has improved, a more personalized approach to treatment has emerged. In cases where the myocarditis is linked to viral infections, antiviral medications may be used, although their effectiveness remains debated due to the varied nature of viral pathogens. For autoimmune-related myocarditis, immunosuppressive therapies such as corticosteroids, Intra Venous Immune Globulin (IVIG) and monoclonal antibodies are increasingly used, although the evidence supporting their efficacy is mixed.

In more severe cases, when acute myocarditis leads to life-threatening complications like severe heart failure or arrhythmias, advanced interventions such as Mechanical Circulatory Support (MCS) may be necessary. Devices like Intra-Aortic Balloon Pumps (IABPs) and Ventricular Assist Devices (VADs) provide temporary support for patients while their heart recovers or as they await a heart transplant. Heart transplantation remains the last-resort option for patients with end-stage myocarditis who do not respond to medical therapy, offering the possibility of long-term survival. While survival rates have improved due to these interventions, they come with their own set of risks, including infection, rejection and complications related to the devices themselves [4].
The role of genetics in acute myocarditis is also gaining attention. Research into genetic predispositions to myocarditis is in its early stages but has the potential to revolutionize our understanding of the disease. Identifying genetic factors that contribute to the development of myocarditis may help clinicians predict which patients are at higher risk for severe outcomes and allow for more targeted treatments. The integration of genetic and molecular data into clinical practice could ultimately lead to a more personalized approach to diagnosing and managing myocarditis.

Despite these advancements, several challenges remain in the diagnosis and management of acute myocarditis. One of the primary difficulties is the variability in clinical presentation, as the disease can range from mild to severe and may mimic other cardiac or non-cardiac conditions. Early diagnosis remains critical, but due to the nonspecific nature of symptoms like fatigue, chest pain and dyspnea, many cases are either missed or diagnosed too late, leading to poor outcomes. Furthermore, while advanced diagnostic tools like CMR and biomarkers have significantly improved detection rates, there is still a

***Address for Correspondence:** Miriam Cohen, Department of Cardiac Thoracic Vascular Sciences and Public Health, University of Padova, 35-100 Padova, Italy; E-mail: miriamcohen@unipd.it*

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need for more reliable and specific tests to confirm myocarditis early on. Additionally, the optimal treatment protocol for acute myocarditis remains unclear, especially in relation to the use of immunosuppressive and antiviral therapies, as evidence supporting their efficacy is still inconclusive [5].

Conclusion

The shifting paradigms in the diagnosis and care of acute myocarditis reflect significant strides in medical technology and our understanding of the disease's underlying mechanisms. From the early days of rudimentary diagnostic methods to the development of sophisticated imaging techniques and biomarkers, clinical practices have undergone a transformation that has dramatically improved patient outcomes. Advances in cardiac magnetic resonance imaging, the use of biomarkers like cardiac troponins and the continued exploration of genetic factors have collectively enabled earlier and more accurate diagnosis. In parallel, the evolution of treatment strategies from basic supportive care to the use of immunosuppressive therapies, mechanical circulatory support and heart transplantation has given clinicians a broader array of options for managing the disease and its complications.

However, despite these advancements, challenges remain in terms of early diagnosis, personalized treatment and the management of severe cases. The heterogeneity of myocarditis, combined with the lack of universally accepted treatment protocols, underscores the need for ongoing research. Future developments in molecular biology, genetic testing and targeted therapies will likely continue to shift paradigms in the care of acute myocarditis, potentially leading to even more effective and personalized interventions. As our understanding of this complex condition grows, the goal remains clear: to improve the prognosis and quality of life for patients affected by acute myocarditis, ultimately reducing the burden of this often-underdiagnosed and misunderstood disease.

Acknowledgement

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Conflict of Interest

None.

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