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Imaging of Inflammation in Unexplained Cardiomyopathy

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CME Objective for This Article: After reading this article the reader should be able to: 1) discriminate an inflammatory cardiomyopathy from other cardiomyopathies based on clinical, laboratory, and imaging data to improve patient management; 2) order timely and appropriate imaging testing in the diagnosis of an inflammatory cardiomyopathy; 3) appropriately utilize PET and MRI in patients with suspected cardiac sarcoidosis to make the correct diagnosis and plan proper treatment; and 4) recognize the limitations associated with noninvasive imaging in patients with suspected inflammatory cardiomyopathies.

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ABSTRACT

Myocarditis is a recognized but underdiagnosed cause of cardiomyopathy due to its wide clinical spectrum and nonspecific presentation. Accurate diagnosis is important because 25% of patients with acute myocarditis develop cardiomyopathy, and of those, approximately 5% per year require heart transplantation or die. Current guidelines for the recognition and treatment of the inflammatory cardiomyopathies are limited. The gold standard for diagnosis, endomyocardial biopsy, has low sensitivity, and thus, multimodality imaging of inflammation plays a crucial role in defining the cardiac abnormalities and in assisting with diagnosis and management. The literature on inflammatory cardiomyopathies is limited to small studies of selected populations due to the diverse etiologies and inherent difficulties in definitive diagnosis. This review focuses on the current and projected use of various imaging modalities, including echocardiography, cardiac magnetic resonance, and nuclear imaging to better define inflammatory cardiomyopathies and aid in their management; it specifically focuses on cardiac sarcoidosis, and giant cell, eosinophilic, and lymphocytic myocarditis. (J Am Coll Cardiol Img 2016;9:603–17) © 2016 by the American College of Cardiology Foundation.

The 2006 American Heart Association expert consensus panel defined cardiomyopathies as a "heterogeneous group of diseases of the myocardium associated with mechanical and/or electrical dysfunction that usually (but not invariably) exhibit inappropriate ventricular hypertrophy or dilatation…"(1); these groups of diseases are categorized by predominant organ involvement into primary (genetic and acquired) and secondary (involves the myocardium as part of a systemic disorder) cardiomyopathies. Myocarditis is defined as inflammation of the myocardium according to clinical, histological, biochemical, and/or immunohistochemical findings (2). Inflammation can be categorized histologically by cell type and/or pattern, including lymphocytic, eosinophilic, giant cell myocarditis (GCM), and idiopathic granulomatous myocarditis (cardiac sarcoidosis [CS]). Infections (often viral), systemic autoimmune diseases, environmental factors, and drugs have all been implicated in myocarditis, but specific genes have not been associated with human myocarditis.

Inflammatory cardiomyopathy is defined as myocarditis associated with cardiac dysfunction (2). The prevalence of myocarditis in unexplained cardiomyopathy is 9% to 40% (3–5). Up to 50% of patients with ventricular arrhythmias have active inflammation on nuclear imaging (6). Identifying inflammation in cardiomyopathy is difficult (7,8). Accurate diagnosis is important, because 25% of patients with acute myocarditis develop cardiomyopathy, of whom approximately 5% per year require heart transplantation or die; treatment may be etiology-specific by using immunosuppressive and guideline-directed heart failure therapies (2). The gold standard for diagnosis, endomyocardial biopsy (EMB), is not consistently performed due to risk, cost, lack of experience and clinical facilities, and variable sensitivity. For example, the sensitivity of right ventricular EMB for GCM is 80% to 85%; it is 93% with combined right and left ventricular biopsies (9,10), but the sensitivity is only 20% to 30% in CS (11). Despite its limitations, EMB may identify cell type, extent of inflammation, and the presence of virus, aiding in disease-specific treatments (12). The current European Society of Cardiology (ESC) position statement on management of myocarditis recommends an etiology-specific strategy (2).

Specialized imaging of myocardial inflammation may provide greater specificity than clinical features at a lower cost and risk than EMB. This review focuses on recent advances in the role of multimodality imaging of inflammation for the diagnosis and management of unexplained cardiomyopathies. **Table 1** provides an overview of inflammatory cardiomyopathies.

OVERVIEW OF IMAGING IN INFLAMMATORY CARDIOMYOPATHY

Because of the nonspecific clinical, electrocardiographic, and echocardiographic features of most inflammatory cardiomyopathies, multimodality imaging of inflammation plays an integral role in the diagnosis and response to therapy, and guiding EMB.