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Review Article

Acute Viral Myocarditis: The Role of Speckle Tracking Echocardiography

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Abstract

Although, an accurate initial diagnosis of acute myocarditis can be challenging to make, all patients with suspected acute myocarditis need a thorough diagnostic work-up and undergo a full imaging evaluation from the very outset to rule out other condition with a similar clinical picture. An acute myocarditis and acute myocardial infarction may musgarate each other, as a result a thorough evaluation is warranted to be certain of the diagnosis, and these patients should be managed in a high cardiac care setting. The diagnosis of an acute myocarditis is based on symptoms, elevated markers of myocardial necrosis, electrocardiographic and imaging modalities including echocardiographic changes. A broad range of diagnostic tools are warranted during the initial diagnostic work-up, however a full echocardiographic evaluation should form an integral imaging modality to rule out other cardiac and systemic disorders, to properly evaluate ventricular function and presence of pericardial collections; and to further guide management.

Keywords: Acute viral myocarditis, Speckle tracking echocardiography

Abbreviations: AVM: Acute Viral Myocarditis; LV: Left Ventricle; RV: Right Ventricle; STE: Speckle Tracking Echocardiography

Introduction

Although, an accurate diagnosis of acute myocarditis could be challenging to make, all patients with suspected acute myocarditis should have a thorough diagnostic work-up and undergo a full imaging evaluation to rule out other causes with a similar clinical picture. An acute myocarditis and acute myocardial infarction may musgarate each other, as a result a thorough evaluation is warranted to be certain of the diagnosis, and these patients should be managed in a high cardiac care setting [1-5]. The diagnosis of acute myocarditis is based on symptoms, elevated cardiac biomarkers suggesting myocardial necrosis, electrocardiographic and echocardiographic changes [6]. In addition to the broad range of diagnostic tools warranted during the initial diagnostic work-up, a full echocardiographic evaluation should form an integral imaging modality to rule out other musgarating cardiac and systemic disorders, to properly evaluate ventricular function and presence of pericardial collections; and to further guide management. Although standard echocardiographic modalities form an integral part of a routine daily practice, speckle tracking echocardiography is a new advanced echocardiographic imaging modality useful for detection of subclinical myocardial and ventricular dysfunction [7]. The main aim of this paper is to review and highlight the role of speckle tracking echocardiographic modalities to facilitate a thorough evaluation of any patient suspected of an acute myocarditis.

Speckle tracking echocardiography

Speckle tracking echocardiography (STE) is a new echocardiographic technology with high sensitivity and reproducibility for detection of subclinical ventricular dysfunction [7]. The invention of advanced STE strain and strain rate indices which are new echocardiographic parameters of the modern era, are useful to evaluate the intrinsic cardiac deformation and should be implemented on daily clinical practice. The STE indices provide an accurate assessment of regional and global ventricular contractility enhanced by angle independency and less pitfalls throughout plane motion compared with convectional 2D-echocardiographic parameters [8]. Based on recent reports, STE

should be recommended on daily clinical practice when evaluating any cardiac conditions, including inflammatory cardiomyopathies [8].

Basic principle of speckle tracking echocardiography

The STE is a rapidly growing technique and an important component of routine clinical practice in recent years. Reports have demonstrated the superiority of STE over tissue Doppler imaging based on various aspects of its deformation imaging [8,9]. Moreover, STE is an easy method to apply, that provides more objective data on myocardial mechanics and reflects the regional and global ventricular functions in a superior way in terms of diagnosis and prognosis. The left ventricle (LV) performs longitudinal shortening-lengthening movements around the long axis, thickening and thinning movements around transverse axis, as well as both thickening-thinning (radial axis) and lengthening-shortening (circumferential axis) movements that occur in the short axis throughout the cardiac cycle [10,11]. As the heart contracts, its myocardial fibers shorten longitudinally and thicken transversely. The right ventricle (RV performs longitudinal shortening-lengthening movements around the long axis which is the important and common deformation parameters adopted on current clinical practice. The frequently used ventricular deformation parameters include the strain, which represent the shortening-thickening in relation to the baseline length proportionally, and the strain rate, which demonstrates this relationship happening within a timeline [10,11]. Both deformation parameters are used to evaluated both ventricles and can be performed on both atria. However, the focus of this current review is on both ventricular myocardial mechanics, particularly the LV.

Reported data using speckle tracking echocardiography in myocarditis

Luis et al. [12], reported a case of a seventeen years old male with acute viral myocarditis, with significantly impaired LV longitudinal, circumferential and radial strain values demonstrated on STE evaluation [12]. In addition, the authors demonstrated a significant attenuation of the inferior, inferolateral and apical segments; with the inferolateral segmenting demonstrating a paradoxical circumferential strain [12].

A recent larger study of twenty-eight consecutive patients with a CMR-verified an acute myocarditis based on the Lake Louise criteria, Løgstrup et al. [13] demonstrated that STE was a useful echocardiographic modality during the initial diagnostic work-up; as the global longitudinal strain added supportive information to clinical and convention echocardiography [13,14]. Furthermore, the authors highlighted that global longitudinal systolic myocardial strain (including both the epicardial and endocardial strain) correlated strongly with the degree of myocardial edema and STE was found useful for diagnosis and evaluation for the degree of myocardial dysfunction [13,14]. The current technological developments in cardiology and cardiovascular imaging have brought new dimensions in diagnosing acute myocarditis and its sequel. Importantly, in the recent past, few reports have also recommended that STE, characterized by the precise evaluation of regional contractility, should be used as an adjunctive tool for confirmatory purposes for the diagnosis of acute myocarditis and inflammatory cardiomyopathy [15,16].

Larger studies

Retrospectively, Hsiao [15] studied a total of 128 cohorts [45 patients with suspected acute myocarditis and 83 healthy controls (mean age 39 years, both groups)], and all underwent a 2-dimensional STE. The study evaluated circumferential and longitudinal strain and strain rate as main study outcome parameters, both as prognostic and diagnostic markers. The study results demonstrated lower circumferential strain, circumferential strain rate, longitudinal strain, and longitudinal strain rate in patients with acute myocarditis patients; where both LV strain and strain rate were good diagnostic and prognostic tools, and these discriminatory features were also demonstrated in those with normal LV ejection fraction [15]. Furthermore, STE was also useful in predicting deterioration and overall event-free survival. In agreement with old case reports, Hsiao et al. [15] also demonstrated that global longitudinal systolic myocardial strain correlated strongly with the degree of myocardial edema. Although there are convincing reports regarding the role of STE on LV, data on RV strain parameters including their prognostic values are still limited.

Conclusion

Acute myocarditis might musgarate other cardiac conditions, including an acute myocardial infarction and as a result a result an extensive evaluation is warranted at first hand to make an accurate diagnosis and guide patient's management accordingly. Echocardiography, particularly STE, is an important and advanced modality to evaluate subclinical myocardial mechanical dysfunction. The STE is a useful echocardiographic tool in acute myocarditis, as acute myocarditis is associated with impaired LV and RV strain parameters. The STE parameters in patients with acute myocarditis are useful, as LV strain and strain rate useful parameters for both diagnostic and prognostic purposes, even in patients with normal baseline LV ejection fraction based on standard transthoracic echocardiography. Furthermore, STE is also useful in predicting ventricular deterioration and event-free survival in patients with acute myocarditis. Although, there is a growing number of case studies, series and even larger data on LV function using speckle tracking strain echocardiographic parameters; data on the importance of RV function are still warranted.

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