REVIEW

CARDIAC MAGNETIC RESONANCE IN THE EVALUATION OF FIBROSIS IN CHAGAS' DISEASE

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Abstract

Introduction: Chagas' disease (CD) is the leading cause of heart failure in endemic regions. Although its pathogenesis is not clearly defined, the cardiac form is characterized by chronic inflammation and myocardial fibrosis (MF). The Cardiac Magnetic Resonance (CMR) is the gold standard noninvasive method for analysis of MF through the myocardial delayed enhancement technique (MDE). Objective: To evaluate the use of CMR in patients with CD, with emphasis on evaluation of myocardial fibrosis and inflammation. Method: Study of literature review, developed from the electronic PUBMED database using the descriptors: "cardiac magnetic resonance", "chagas disease" from January 1993 to June 2014. Results: Of the 62 articles found, 10 were selected. Three of these studies compared CMR with endomyocardial biopsy and failed to demonstrate a high sensitivity of CMR for detecting MF. Recently, some authors have been investigating MF and cardiac inflammation with CMR in Chagas' disease, and were able to establish the CMR as an important tool for prognostic stratification of patients with chronic chagasic cardiomyopathy (CCC). Conclusions: CMR is an important diagnostic tool in cardiac involvement in CD, allowing more precise stratification of its severity stages.

Keywords: Chronic chagasic cardiomyopathy; Cardiac magnetic resonance imaging.

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INTRODUCTION

It is estimated that 8 million people worldwide are infected by Trypanosoma cruzi, with about 50,000 new cases per year, of which about 20-40% will progress to the symptomatic form of the disease.[1-4] Chronic chagasic cardiomyopathy (CCC) is a low-intensity, slowly progressive and relentless myocarditis. In endemic regions, American trypanosomiasis stands out as the main cause of heart failure syndrome.[5]

Although the pathogenic mechanisms related to CCC are still unclear, there is evidence that cardiac damage in chronic T. cruzi infection is due to the persistence of the parasite, accompanied by chronic inflammation and autoimmune mechanisms. Thus, the CCC is essentially a dilated cardiomyopathy caused by chronic inflammation with progressive tissue destruction and extensive fibrosis of the myocardium.[6-8]

The CMR has been established as an important tool for diagnosis of cardiovascular diseases.[10] This is a noninvasive test that uses no ionizing radiation and is able to provide images with high spatial resolution of cardiac structures for anatomical and functional analysis. The use of gadolinium, a paramagnetic contrast, contributes to the high sensitivity of CMR in the detection of inflammation and MF. The CMR is the exam "gold standard" for noninvasive evaluation of MF today.[9,10]

Identifying CD patients that will develop CCC is not yet possible. However, the detection of myocardial involvement is beneficial for the characterization of MF and inflammation in CD and may help to better understand the physiopathology of the disease and to identify patients at risk for progression. In this context, the CMR appears to play a critical role in the prognosis and risk stratification of these patients.[9,10]

This article discusses the current evidence of the use of CMR in CD, with emphasis on evaluation of myocardial fibrosis and inflammation. This study is a narrative review, developed with the scientific production indexed in the electronic PUBMED database using the descriptors: "cardiac magnetic resonance", "chagas' disease" from January 1993 to June 2014.

RESULTS

We were able to identify 62 articles. Only 10 of these articles described the CMR exclusively in CD patients, emphasizing the myocardial fibrosis and inflammation, and they will be used in this review. Experimental studies were excluded and those that contained data from several cardiomyopathies in addition to chronic Chagas cardiomyopathy.

Previous studies comparing CMR and endomyocardial biopsy (EB), the gold standard method for diagnosis of invasive cardiac inflammation, demonstrated the high sensitivity of this test to detect myocarditis.[11-13]

In a pioneering study, Bocchi et al. describes the correlation between CMR results and EB for the diagnosis of myocarditis in CD. Ten male patients with CCC underwent EB and the RMC. The results of this group were compared with a control group with idiopathic dilated cardiomyopathy. All CD patients showed higher signal intensity after administration of gadolinium at CMR. In EB, eight of these patients had obvious signs of myocarditis and two patients had borderline evidence of myocarditis. In the control group, only one patient had borderline histological diagnosis of myocarditis and none had myocarditis.[13]

In another article, Kalil et al. evaluated the signal intensity of the CMR with gadolinium in patients with CCC, comparing the signal intensity of skeletal muscle with the intensity of the free wall and septum of the heart before and after infusion of gadolinium. There was a relative increase in signal intensity after infusion of gadolinium in myocardial regions.[14]

These studies, despite the small number of patients, demonstrated that CMR can noninvasively detect the presence, location and the heterogeneous distribution of the inflammatory process in CD. In addition, this technique has the advantage to detect focal inflammatory changes in the myocardium that may go unnoticed by EB.

Rochitte et al. studied a larger number of patients and they have been classified into 3 groups: Group 1 - 15 patients with the indeterminate form of CD; Group 2 - 21 patients with abnormal

electrocardiogram (ECG) and / or left ventricular dysfunction and group 3 - 10 patients with CCC and ventricular tachycardia (VT). MF was identified in 20%; 84.6% and 100% in Groups 1, 2, and 3, respectively. The lower apex and inferolateral segments were the most involved. The MF increased progressively from segments with normal function for those with mild hypokinesia, severe hypokinesia, akinesia and dyskinesia. The extent of fibrosis was directly correlated with the stage of the disease and the N.Y.H.A. functional class and, conversely, with the LV ejection fraction (LVEF), contributing to the prognostic stratification in CCC.[15]

In a research conducted in a non-endemic area, 67 patients were classified into 3 groups: Group 1: 27 with the indeterminate form; Group 2: 19 with abnormal ECG or echocardiography, but without left ventricular dysfunction and / or abnormal regional contractility and group 3: 21 patients with abnormal regional contractility and / or LV end-diastolic diameter> 55 mm and / or LVEF <50%. Prevalence of myocardial delayed enhancement was observed in 15.8% of patients in group 2 and 52.4% in group 3. The apex and inferolateral wall demonstrated a higher MDE and this has been correlated with areas of higher prevalence abnormal contractility. The distribution of MDE was heterogeneous (transmural, subepicardial, and subendocardial myocardial), and it is not possible to determine a specific pattern for CD.[16]

Mello et al. studied the CMR as a predictor of VT, a frequent cause of sudden death in the CCC. Fourty one patients with CCC were enrolled, 26 subjects had a positive history of VT, and 15 had a negative history of VT. All included patients had MDE and abnormal left ventricular segmental contractility in CMR. There was no statistical difference in MDE² volume between the two groups: VT group = 30.0 ± 16.2%; NVT group = 21.7 ± 15.7%; p = 0.118. The probability of VT was higher if two or more contiguous areas of transmural fibrosis were present, (RR 4.1, p = 0.04). The agreement between observers was 100% in this test (p <0.001). Thus, the identification of two or more segments by MDE of transmural fibrosis is associated with the occurrence of VT in patients with clinical CCC. Thus, CMR can be considered as a tool for risk stratification in this population.[17]

A recent publication evaluated the CMR in CD as a tool for detecting myocardial inflammation. Fifty four patients were classified into 3 groups: Group 1: 16 with the indeterminate form; Group 2: 17 with the cardiac form without left ventricular dysfunction and group 3: 21 patients with LV systolic dysfunction. The MF was present in 72.2% of patients: 12.5% in group 1, 94.1% in group 2 and 100% in group 3 (p <0.0001). The myocardial inflammation was assessed by two parameters: coronary hyperemia and edema. Approximately 78% of the patients had edema (31.3%, 94.1% and 100% groups 1, 2 and 3 respectively). The hyperemia was identified in 73.8% of cases: 25.0% in the indeterminate form, 92.3% in those patients without left ventricular dysfunction and 94.1% in those with left ventricular dysfunction. CMR could predict myocardial inflammation even in subclinical forms of the disease. The presence and degree of inflammation was associated with impaired ventricular function.[18]

CONCLUSION

In patients with CD, CMR has the ability to identify cardiac involvement, either by detecting areas of MDE, to identify MF, or by detecting myocardial edema and hyperemia to assess cardiac inflammation. These findings seen by the CMR seem to correlate well with the abnormalities of the regional contractility, with global LV dysfunction, with stages of clinical severity of heart failure and with VT, which allows its use for more precise stratification of the severity stages of this cardiomyopathy.

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