Cardiac magnetic resonance imaging in peripartum cardiomyopathy: A comprehensive imaging approach

T. Elgeti[1], D. E. Kivelitz[2], D. Habedank[3], B. Hamm[1], R. Röttgen[1], and D. M. Renz[1]

[1]Department of Radiology, Charité Universitätsmedizin Berlin, Berlin, Germany, [2]Albers-Schönberg-Institut für Strahlendiagnostik, AK St. Georg, Hamburg, Germany, [3]Department of Cardiology, Charité Universitätsmedizin Berlin, Berlin, Germany

Background: Peripartum cardiomyopathy (PPCM) is a possible life-threatening cardiac disorder, which affects previously healthy women late in their pregnancy or in their early puerperium [1]. The incidence of PPCM shows large geographic variations, ranging from 1 in 300 life births in Haiti and 1 in 1000 life births in South Africa to around 1 in 3000 life births in Europe and the United States [1]. The following diagnostic criteria have been introduced: a) onset of heart failure in the last month of pregnancy or within five months postpartum; b) absence of heart disease prior to the last month of pregnancy; c) absence of an identifiable cause for the cardiac failure [2]. The etiology of this uncommon, but increasingly recognized disease is not fully understood [1].

Problem: In the diagnosis of PPCM there have been only a few reports using cardiac MR imaging (CMRI) cine sequences to evaluate left ventricular systolic function and late gadolinium enhancement (LGE) images to assess possible myocardial fibrotic or necrotic damage of the left ventricle. However, the majority of patients suffering from PPCM present no myocardial LGE [3].

Objective: The aim of our study therefore was to evaluate a comprehensive CMRI protocol, including assessment cardiac function, characterization of inflammatory changes as well as LGE of the left ventricle. The purpose was to estimate the value of this comprehensive CMRI approach for diagnosis and follow-up of patients suffering from PPCM.

Materials and Methods: Retrospective search of the department's MR database was accomplished and revealed 12 comprehensive cardiac MR examinations performed in 6 patients with clinical diagnosis of PPCM in the years 2005-2009. 5 of these scans had been performed during initial presentation of the patient, 2 scans on intermediate time points and 5 scans during follow-up. Additional clinical information was obtained from the file database, e.g. information on initial clinical presentation, echocardiography, pregnancy, electrocardiogram (ECG) changes and invasive procedures. As in other published studies, the assignment of PPCM against myocardial inflammation due to infection, e.g. myocarditis, was made on clinical characteristics [2]. A standardized comprehensive CMRI protocol was performed on 2 1.5 T scanners including the following techniques: Steady state free precession (to assess left ventricular function), T2 weighted (myocardial edema, T2 ratio), early (global relative enhancement (RE), reflecting increased capillary leakage) and late T1 weighted imaging after gadolinium-DTPA injection (LGE, reflecting irreversible myocardial injury) [4]. Normal values for tissue characterizing parameters are given in the literature [4].

Results: An example for initial and follow-up examination is shown in figure 1. In the initial MR examinations, 3/5 patients presented elevated left ventricular end-diastolic volume (LVEDV/body surface area, BSA), 1 woman normal, 1 patient LVEDV/BSA in the upper range. (mean value 134.3, SD 29.0, range 109-166 ml/m^2). In 4/5 patients, a reduced left ventricular ejection fraction (LVEF) was found (EF: 19-47%, normal range 54-74%); elevated T2 ratio (mean 2.6, SD 0.3); and/ or RE values (mean 7.2, SD 1.5) were assessed in all patients. No LGE was detected in initial scans. In follow-up examinations (on average 89 ± 31 days after the initial scans), a reduction of LVEDV/BSA and an increase of LVEF were found in all patients. The tissue characterizing parameters reduced to normal in all but 2 patients. In those 2 patients (1 intermediate scan, 1 follow – up scan), LGE was detected; these patients did not present a favorable clinical course.
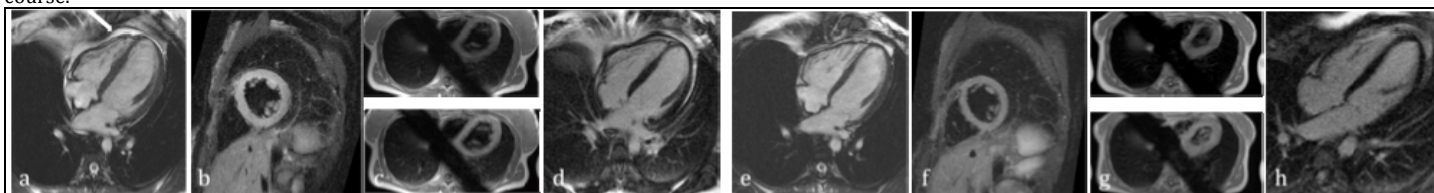

Figure 1: Initial (a-d) and follow-up (e-h) MR examination (52 days after initial scan) of patient No. 2 (32-year-old woman).
The cine images (a, e) in the four-chamber view demonstrate a reduction of the LVEDV in the course of the disease. Small pericardial effusion is seen in initial scan (a; arrow). T2-weighted, fat saturated images in the short cardiac axis show global myocardial edema on the initial scan (T2 ratio 2.6; b) and reduction of the edema ratio on follow-up scan (T2 ratio 1.8; f). In the global relative enhancement (RE) sequences in transverse localization, a reduction of the RE value is measured from 5.9 in the initial scan (c; precontrast (top) and postcontrast (bottom) image) to 3.5 in the follow-up scan (g). No LGE is found on initial (d) or follow-up scan (h).

Discussion and conclusion: In patients with PPCM CMRI demonstrates not only left ventricular dysfunction but also inflammatory changes of the left ventricular myocardium, which decreased with recovery of left ventricular systolic function.
CMRI provides further insight into the pathophysiological mechanism of PPCM, supporting the hypothesis of underlying myocardial inflammation. Additionally, CMRI may provide useful information on differential diagnosis and possible course of the disease. In our limited number of patients, constant elevation of tissue characterizing parameters (T2 and RE) and the evidence of LGE is associated with a poor clinical course.

References:
[1] Sliwa K, Fett J, Elkayam U (2006) Peripartum cardiomyopathy. Lancet 368:687-693.
[2] Demakis JG, Rahimtoola SH (1971) Peripartum cardiomyopathy. Circulation 44:964-968
[3] Mouquet F, Lions C et al. (2008) Characterisation of peripartum cardiomyopathy by cardiac magnetic resonance imaging. Eur Radiol 18:2765-2769.
[4] Zagrosek A, Abdel-Aty H, et al. (2009) Cardiac magnetic resonance monitors reversible and irreversible myocardial injury in myocarditis. JACC Cardiovasc Imaging 2:131-138.