Cardiac Magnetic Resonance Imaging of Master Marathon Runners: Prevalence and Ethiology of Myocardial Late Enhancement

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Introduction: Epidemiologic studies demonstrated that regular physical activity is associated with an improvement of cardiovascular prognosis. However, cardiovascular events can occur in association with marathon running. Atherosclerosis is the main cause of exercise related death in persons >35 years. So far, the need for risk stratification in master marathon runners is under discussion and only few data exists concerning adequate risk stratification in these athletes. Cardiac magnetic resonance imaging (cMRI) has become an established imaging modality for the assessment of different cardiac disorders. Thus, our study aimed to investigate the cardiac effects of endurance sports and to assess the prevalence of asymptomatic myocardial pathologies in non-professional male marathon runners aged >50 years by means of gadolinium-enhanced MRI.

Methods: Following written informed consent, 105 male asymptomatic marathon runners (at least 5 completed marathon races within the last three years) aged 50-72 years were enrolled in accordance with the regulations of the local institutional review board. All examinations were performed on a 1.5T MR scanner (Magnetom Avanto, Siemens medical solutions, Erlangen, Germany). For the assessment of the left ventricular function steady state free precession cine sequence (TrueFISP: TR 3 ms, TE 1.5 ms, FA 60°) was acquired in standard long and short axis views. Based on these measurements left ventricular volumes, left ventricular mass and ejection fraction were calculated. Fat-suppressed T2-weighted turbo spin echo sequences (TR two heart beats, TE 49 ms, FA 180°) were measured to detect myocardial edema. Additionally, an inversion recovery fast low angle shot sequence (IR-turboFLASH: TR 8.0 ms, TE 4.0 ms, TI 180-240 ms, FA 20°) was acquired in short and long axis views 10 to 15 min after injection of a 0.2 mmol/kg bodyweight of Gadolinium-DTPA (Schering AG, Berlin, Germany). In case of any late enhancement rest and adenosine stress perfusion scans were acquired for the assessment of myocardial ischemia.

Results: The MR imaging protocol could be completed in 102 (97%) individuals. Left ventricular volumes (mean EDV 138 ± 32 ml; mean ESV 52 ± 17) and mean ejection fraction (62 ± 8%) turned out to be comparable to previously published data of "non-athletic" study groups whereas the mean left ventricular mass (141 ± 27g) emerged to be slightly higher. None of the subjects showed myocardial edema on T2-weighted images. 11 subjects (11%) showed areas of late enhancement. 8 subjects showed focal areas of LE with a non-ischemic distribution (Fig. 1) whereas three patients (3%) showed subendocardial LE suggestive for ischemic myocardial scarring. In two of these 3 patients adenosine stress MRI showed perfusion defects and coronary artery disease was confirmed by catheter angiography in two patients.

Conclusion: Our results demonstrate an unexpected high prevalence of late enhancement indicating myocardial damage. Whereas in 3 subjects an ischemic origin of the late enhancement was assumed by MRI and proven by catheter angiography, the origin of the late enhancement in the additional 8 subjects remains unclear and potential explanations include residual myocarditis, fibrosis due to hypertrophy and microembolization. However, the assessment of late enhancement may serve as a component of risk stratification in senior endurance athletes, but a long-term follow up of our subjects is necessary for the evaluation of the prognostic relevance of any myocardial late enhancement.

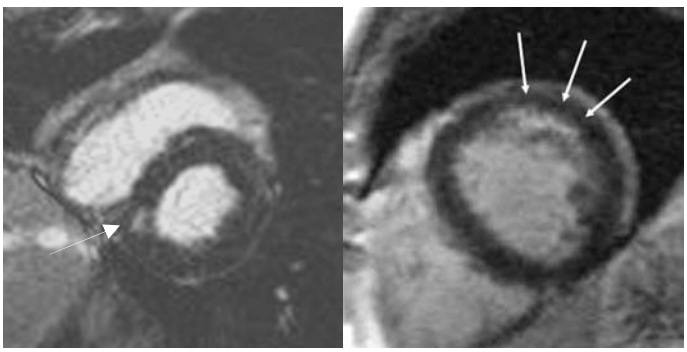

Fig. 1 a, b: Short axis view of a spotted midmyocardial hyperenhancement suggestive for non-ischemic genesis (a) and subendocardial hyperenhancement due to coronary artery disease (b).