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Diagnostic Value of Cardiac Magnetic Resonance Imaging for the Analysis of Heart Morphology and Function and Correlation to Serological Markers in Patients with Systemic Lupus Erythematosus

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SLE is a chronic inflammatory disease which displays a wide variety of organ manifestations. Disease-related inflammatory and immunological processes have been associated with the pathogenesis of myocardial necrosis and dysfunction in SLE patients. Consequently, patients with cardiovascular complications are exposed to increased morbidity and mortality. Prevention and treatment of cardiovascular disease are major considerations in the disease management of patients with SLE.

CMR can be used for a morphological and functional myocardial assessment. CE-CMR has the ability to identify microvascular non-infarct-specific inflammatory processes. The purpose of this study was to investigate the clinical utility and diagnostic performance of CMR comparing SLE patients to healthy controls, describe the extent of cardiovascular involvement in SLE and investigate a potential correlation with serological markers.

Our cohort included 29 SLE patients (26 females, 3 males, 44 ± 13 years) and 120 healthy volunteers served as a control group to compare values. CMR examinations were performed on a 1.5T scanner and included left/right ventricular functional cine imaging and CE-CMR after gadolinium-DTPA injection (0.2mmol/kg). Two experienced CMR cardiologists evaluated the images in consensus describing the presence, morphology and distribution of CMR-LGE foci

using the AHA-17-segment model. The CMR findings were compared to serum levels of NT-proBNP and hs-cTnT as markers of heart insufficiency and necrosis and to HMGB1 concentrations as a marker for inflammation.

The combined functional and morphological MRI approach detected a considerable amount of cardiac abnormalities in SLE patients suggesting microvascular infarcts and chronic inflammatory processes in subclinical cardiac involvement. Gadolinium tissue characterization identified the presence of infarct-typical and infarct-atypical LGE in 70% of our SLE patients. The most common findings were infarct-atypical LGE patterns, which could be seen in about one third of the patients. In addition, our investigation showed that CMR-LGE could be used to detect lupus cardiomyopathy.

Functionally, although CMR imaging revealed pronounced LV-involvement, LV function and dimensions were preserved. In contrast, RV remodeling with increased chamber volumes (RV-ESV and EDV) could be detected (84 ± 21 ml vs. 67 ± 25 ml, p=0.01; 178 ± 30 ml vs. 155 ± 48 ml, p=0.002), leading to the hypothesis that other mechanisms like increased pulmonary pressure or vascular stiffness have to be taken into account for RV remodelling.

The prevalence of myocardial LGE abnormalities could not be correlated to HMGB1 levels. Our patients had low disease activity levels during the study, suggesting that chronic inflammation could be a key mechanism in the pathogenesis of cardiac involvement rather than acute exacerbations of the disease. The morphological and functional cardiac abnormalities were not associated to NT-proBNP and hs-cTnT concentrations.

Our results may have practical implications in the disease management of SLE patients in the future. The question that arises is whether CMR imaging could replace echocardiography in the cardiac screening of SLE patients. Since CMR imaging can detect more cardiac abnormalities

than transthoracic echocardiography, which is currently widely available in clinical institutions, both methods could be used to complement each other and offer more information.

Taking into consideration the high cardiovascular morbidity and mortality in SLE patients and the difficulty in the early detection of cardiac manifestations, CMR imaging could therefore serve as a versatile non-invasive clinical tool to assess cardiac SLE involvement, accurately and reproducibly assess ventricular function and potentially monitor inflammatory regression during and after medical treatment. Consequently, its application could contribute to the creation of new pathways in disease management, therapy monitoring and prognosis in SLE patients.