Cardiovascular MR (CMR) is of growing impact in the clinical setting, nevertheless there are a lot of not well defined areas. The distribution of clinical guidelines including CMR and well-defined teaching criteria will help to overcome this. Whereas it is necessary to get robust protocols working in a clinical scenario, innovative developments are required.

Increasing the field strength comes along with increases in signal- and contrast-to-noise ratio. This benefit is expected to be translated into higher spatial and temporal resolution and faster imaging techniques. However, increasing the field strength also means to increase the technological challenges, e.g. to achieve sufficient homogeneity of the magnetic field within the scanner, requiring many innovation by experienced physicists and engineers.

Hence, the technique itself is only a part of the challenge. The clinical challenge is to define the place or the chance of 7T. The bar of each diagnostic tool is the diagnostic accuracy compared to different gold standards and its impact on patient outcome. Thus, to lead CMR at 7T to reasonable success requires close cooperation between physicists and physician scientists.

At present, 7T today is in the very beginning and the first challenge was to prove its capability to perform basic cardiac scans.

Recently, the first steps of human cardiac imaging at 7T have been gone successfully evaluating the left ventricle: Cine imaging and cardiac chamber quantification can be realized in a robust and accurate mode, and the first images with impressing blood-tissue contrast despite very small slice thickness 1-4. Usually the left ventricle is in the focus in clinical scenarios and research. But based on a growing understanding of disease mechanism the atria and the right ventricle (RV) are coming back to mind. The assessment and quantification of the RV using conventional methods (like echocardiography) is challenging, because the RV is not following a geometric model. CMR is accepted as the only method accurate method to assess the RV based on a 3D coverage. It was shown e.g. in congenital heart disease, that function and volume of RV have a prognostic impact. Nevertheless, we are aware of different subtle wall motion abnormalities of the free wall of unknown impact. That lack of knowledge is based on one hand on missing outcome data, but the planning and realization of those trials is also delayed, because on the other hand the visualization and interpretation of different findings are uncertain. One could assume, that the expected advantages of 7T could overcome some of the limits.

Nevertheless, before CMR at 7.0T can be applied in the wide range of diseases, safety basic homework has to be done.
Three-chamber view obtained using the gold-standard, SSFP cine imaging at 1.5 Tesla, and using fast gradient echo (FGRE) cine imaging in combination with a 4-element coil and acoustic cardiac triggering at 7 Tesla, demonstrating the principal feasibility of cine imaging at 7 Tesla.

Axial RV view (selection) using fast gradient echo (FGRE) cine imaging in combination with a 16-element coil and acoustic cardiac triggering at 7 Tesla

These images, and the research in the field of CMR at 7T as a whole, were realized within close cooperation between the working group of CMR of the Charite Medical University Berlin, and the Berlin Ultrahigh Field Facility (B.U.F.F) located at the Max-Delbrueck-Centre headed by Prof. Thoralf Niendorf (Charité, MDC).

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