

Explorations into CV Disease Using 7T

Emerging Applications of Cardiovascular MR at 7T

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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. Meanwhile, a growing number of centers are stepping into the field.

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.

First steps of human cardiac imaging at 7T have been gone successfully: 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 2} Until now the published experience is based on healthy volunteer studies. Experiences in patients are needed to enhance our knowledge.

All further steps are based on careful technical developments of soft- and hardware. Dedicated coils have to be developed. Several models are introduced and have to survive a more "routine" use.^{3, 4}

That opens the door to focus on new steps into the myocardium. There is first evidence that CINE-myocardial T2* mapping using susceptibility weighted gradient-echo imaging is feasible at 7.0T.⁵

Meanwhile next generation sequences are in development.

Nevertheless, before CMR at 7.0T can be applied in the wide range of diseases, safety basic home-work have to be done. For example, the patient safety in case of coronary stents has to be clarified, there is first evidence that stents will not hamper the whole field.⁶

The talk will give an overview on current state of the art based on ongoing research of different centers. The intention is to share thoughts and to learn lessons from different centers around the world.

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