Electrophysiology study guided by real-time magnetic resonance imaging

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Interventional procedures guided by magnetic resonance imaging (MRI) are highly attractive. Benefits relate to (i) the fluoroscopy-free environment, (ii) substrate analysis, and (iii) lesion visualization. A stepwise strategy in the development of this technology is mandatory proceeding from (i) diagnostic procedures to (ii) ablation of simple arrhythmias and (iii) complex ablation procedures. In the following, we present the results of step (i).

A diagnostic electrophysiology study (sinus node recovery time, antegrade and retrograde atrioventricular conduction) was performed in a 1.5 T whole-body MRI scanner (Intera, Philips, Best, The Netherlands). Two MRI compatible steerable diagnostic/ablation catheters (Vision™, Imricor Medical Systems, Burnsville, MN, USA) were inserted via the femoral sheaths and manipulated exclusively using MRI guidance. Using a commercially available interactive real-time steady-state free precession MRI sequence and passive catheter tracking, the catheters (indicated by asterisks in Panels A–D) could be placed successfully in the right ventricle [Panels A and B; right anterior oblique (RAO) view] and in the right atrium (Panels C and D; RAO view) confirmed by intracardiac electrograms (Panel G). Programmed stimulation manoeuvres were performed (Panel H, ventricular pacing) with the respective one-channel surface electrocardiographic (ECG) recordings displayed by an additional monitor (Panel E, unpaced; Panel F, ventricular paced). During and after the procedure, no adverse effects were observed.

To our knowledge, this is the first case of real-time MRI-guided placement of multiple catheters in a human with subsequent performance of stimulation manoeuvres. Besides the mentioned benefits, this technology still encounters several limitations, which have to be solved before application in a routine clinical setting. Challenges arise from delineation of precise surface ECG recordings in the MRI setting along with intracardiac electrograms, easier handling of catheters, visualization of catheters placed in the coronary sinus, facilitation of immediate defibrillation in the MRI setting, and implementation of an active catheter tracking system. Developments are under way moving this promising technology closer.

Conflict of interest: C.P. has received modest lecture honoraria from St Jude Medical and Biotronik and is a member of the St Jude Medical advisory board. G.H. has received modest lecture honoraria from St Jude Medical, Biotronik, Medtronic, and Biosense and is a member of the St Jude Medical and Biosense advisory board. M.G. has received modest lecture honoraria from Philips and Siemens.

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