[Active instrumental guidance in interventional MR tomography: introduction to a new concept]

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PURPOSE: An active MR-based guidance system for visualisation of invasive instruments is described. METHODS: The principle of MR tracking is based on the integration of a miniaturised coil into the tip of the instrument itself. A phantom experiment was designed to demonstrate the localising accuracy of this technique. In addition, biocompatibility and warming effects were evaluated. Preliminary intravascular applications that were performed in animal experiments under MR guidance included embolisation, vascular occlusion as well as transjugular intrahepatic punctures. Percutaneous biopsies, cholecystostomies and laparoscopic applications were also evaluated with MR tracking. RESULTS: Phantom experiments confirmed an excellent localisation accuracy of MR tracking compared to conventional radiography. At a field strength of 0.5 T, the temperature increase remained below 2 degrees C. Results of phantom experiments revealed a potential of significant heating dependent on the sequence parameters employed. MR tracking allowed a robust, simultaneously biplanar visualisation of the instrument tips in real time. Based on MR "road map" images, various intravascular and percutaneous interventions were successfully performed in vivo under MR guidance. CONCLUSIONS: MR tracking is a flexible concept permitting monitoring in the guidance of instruments in an MR environment. Various preliminary in vitro and in vivo experiments demonstrate safety, localisation accuracy and feasibility of this biplanar localisation technique in real time.

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