

## **Comparison of gradient echo and spin echo sequences in interventional MR imaging: Is there a single optimal sequence for all purposes?**

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**Purpose:** To compare the appropriate pulse sequences for interventional device guidance during MR imaging at 0.2 T and to evaluate the dependence of sequence selection on the anatomic region of the procedure.

**Material and Methods:** Using a C-arm 0.2 T system (Magnetom Open, Siemens), four MR sequences with similar temporal resolution were applied in 23 liver cases and during MR-guided neck interventions in 13 patients. In addition, 15 volunteers were examined. The imaging protocol consisted of: multislice turbo spin echo T<sub>2</sub>w (2000/105/2/17 TR/TE/NSA/ETL), sequential slice PSIF (17.9/12.1/2/50° TR/TE/NSA/FA), FISP (17.8/8.1/2/90° TR/TE/NSA/FA), and True – FISP (12.5/5.9/3/90° TR/TE/NSA/FA). Slice thickness was 6 mm in liver imaging and 5 mm in neck imaging. In-plane spatial resolution was 3 mm in liver imaging and 2 mm in the neck. Liver images were acquired during breathhold. Vessel conspicuity and contrast to noise ratio (CNR) were calculated for each sequence. A Differential Receiver Operating Characteristic (DROC) was performed in a side-by-side comparison by two radiologists blinded to the sequence type and the presence of lesions.

**Results:** Liver findings included hemangioma, cholangiocarcinoma, metastases, and cysts, all of which were detected using the turbo spin echo sequence. PSIF, FISP, and True–FISP imaging showed lesions in 95%, 74%, and 68% of cases, respectively. The turbo spin echo sequence offered the best CNR followed by PSIF imaging. DROC analysis also rated turbo spin echo and PSIF to be the superior sequences.

Imaging findings in the head and neck included metastases, amyloid, vascular malformation, and cysts. Lesions were detected in all cases by turbo spin echo, FISP, and True – FISP imaging, and in 80% using PSIF. True – FISP offered the best CNR followed by turbo spin echo imaging. In the DROC analysis, there was no significant difference between the sequences. Vessels appeared bright on FISP and True – FISP imaging and dark on the other sequences.

FISP was the sequence of choice in the majority of cases during MR-guided interventions in the neck (10 of 13), due partially to vascular conspicuity. In contrast, image guidance for interventional MRI during liver procedures was best achieved by PSIF or turbo spin echo T<sub>2</sub>w imaging.

**Conclusion:** In interventional imaging, no single sequence fits all purposes. There is a clear relationship between the sequence selection and the anatomical region of the MR – guided procedure. Image guidance for interventional MR during liver procedures was best achieved by PSIF or turbo spin echo T<sub>2</sub>w imaging, whereas biopsies in the head and neck were best performed utilizing FISP or True – FISP sequences. We conclude, therefore, that there is a clear relationship between the optimal sequence for visualization and guidance and the anatomical region of the MR – guided procedure.