

# Biopsy of liver lesions with MR fluoroscopy using an high field open MRI Scanner

F. Fischbach<sup>1</sup>, J. Bunke<sup>2</sup>, M. Thormann<sup>1</sup>, G. Gaffke<sup>1</sup>, J. Kerstin<sup>1</sup>, and J. Ricke<sup>1</sup>

<sup>1</sup>Otto von Guericke University, Magdeburg, SA, Germany, <sup>2</sup>Philips Healthcare, Hamburg, HH, Germany

## INTRODUCTION

MR imaging, combining an excellent soft tissue contrast without radiation exposure and an arbitrary slice selection, must be considered as an attractive method for fluoroscopic guided liver biopsies. So far most procedures were performed in cylindrical closed bore systems with time-consuming and cumbersome procedures because of the restricted access to the patient or in low field open systems providing only limited image quality and frame rates due to the low Bo (1-3). With the introduction of high field open-configured magnets with vertical field orientation, the attention is drawn back to MR guided interventional techniques directly performed by the radiologist not using any robotic devices. The purpose of this study was to assess the feasibility of liver biopsies using the free hand technique with real time MR fluoroscopy in a new type of MR system.

## METHODS

Patients with focal liver lesions in the hepatic dome or lesions only visible on MRI were included in the study. MR guidance and monitoring were performed using a 1.0T system (Panorama<sup>®</sup>, Philips Healthcare, Best, The Netherlands) and a ring-shaped 21-cm-diameter surface loop receive-only coil placed in the region of the liver. Patients received 0,1 ml per kg of a solution of Gd-EOB-DTPA (Primovist<sup>™</sup>, Bayer Schering) 20 minutes prior to the intervention. Skin entry site was defined with finger pointing using an user interface for interactive fast dynamic imaging with a T1-w GRE-sequence (FFE, TR/TE/α: 11ms/6 ms/35°, 1 frame per second).

An 18-gauge MR-compatible biopsy needle was placed stepwise with repeated image updates. Slice orientation was in plane with the needle path and interactively changed using a foot pedal from axial to the perpendicular paracoronal plane and vice versa, thus displaying possible deviations of the needle path from the planned trajectory. After final positioning of the needle its correct placement was documented with a T1w 3D high resolution isotropic volume examination (THRIVE; TR/TE/α: 5.4ms/2.6 ms/12°) perpendicular to the needle pathway.

Breath hold T2w TSE sequences (TR/TE: 1600ms/110 ms) in transversal orientation were added to rule out post- interventional hematoma.

## RESULTS

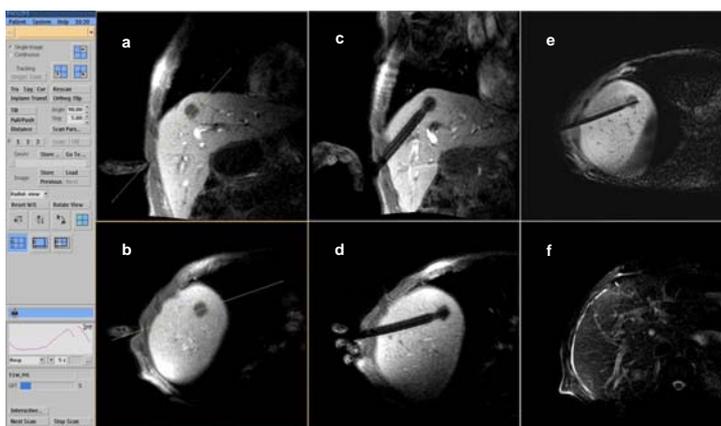
In total 50 patients were biopsied. On average the lesion size was 18mm (7-34mm). All lesions were visible on MR fluoroscopic images and sharply delineated to the surrounding liver parenchyma. In all patients the biopsy was technically successful and solid specimens were obtained. 93% showed a histopathologic pattern other than native liver tissue confirming the correct position of the needle. Time between determination of the lesion and the control scan was on average 18min (10-30min). As the intervention was performed constantly from the side with a lateral approach perpendicular to the vertical magnetic field the artifact size of the needle was relatively constant and ranged between 3 to 5mm in the control imaging. Postinterventional subcapsular hematoma was seen in almost half of the patients with an average maximum in diameter of 4,5mm (2-14mm). No major complications were recorded.

## DISCUSSION

In conclusion, the open 1T system offers an excellent opportunity for biopsies performed with MR fluoroscopy. T1w GRE imaging was suited best for MR-guidance of biopsies in the liver. All lesions could be delineated in excellent quality. A frame rate of 1 image per second offered sufficient time resolution for fluoroscopy purposes in order to follow the progressive motion of the needle. The technique requires only the basic interventional package and uses a skill set that is already familiar to radiologists who regularly perform percutaneous procedures.

## REFERENCES

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**FIGURE 1:**

Biopsy of the liver using the interactive mode.

Image planes could interactively be adjusted to image the entrance point and the lesion in one plane. Perpendicular to this plane a second plane was adjusted to follow the pathway in two perspectives. Images were acquired in continuous mode with a frame rate of 1 image per second.

Finger pointing to determine the entrance point in coronar (a) and transversal (b) orientation. Puncture of the lesion in corresponding slice orientations (c/d). Control of intra-lesional needle position with THRIVE (e) and of post-interventional hematoma with T2-w TSE in transversal orientation (f).