Prostate biopsy in supine position in a standard 1.5 T scanner under realtime MR-imaging control using an MR-compatible endorectal biopsy device

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Introduction:

Adenocarcinoma of the prostate is the most commonly diagnosed cancer in men in the United States [1]. Despite a prostate specific antigen (PSA) level greater than 4ng/ml, approximately 66% of patients will have a negative biopsy following ultrasound guided sextant sampling. 19% of cancers were found at a second and another 8% of cancers were found at a third prostate biopsy [2]. Endorectal MRI and MR spectroscopy posseses a higher accuracy in diagnosing cancer in comparison to transrectal sonography (TRUS) and can detect additional tumor areas in patients with prior negative prostatic biopsy [3, 4]. First reports regarding MRI-guided prostate biopsy procedures use devices with transperineal access to the prostate [5] or with a transrectal access with the patient in a prone position [6], whereby this study uses a device in which the biopsy is performed in supine position .

Purpose:

To investigate a biopsy device (MRI Devices Daum GMBH, Schwerin Germany) for MRI-guided transrectal prostate biopsy in patients with elevated PSA levels, negative tumor results in transrectal ultrasound (TRUS) and a number of previous tumor negative prostate biopsies.

Method and Materials:

20 patients underwent MRI-guided prostate biopsy in a 1.5 T system (Symphony Quantum, Siemens Medical Solutions, Erlangen). The patients were positioned supine and feet first laying with their back at the front end of the patient table on a special holding device for the posterior CP-body-array coil (Fig. 1). The legs of the patient rested on a specially developed patient table extension, which was mounted from the rear of the magnet to the patient table (Fig. 1). The biopsy device itself was mounted on the patient table extension (Fig. 1). The device consists of a needle guide, endorectal sheath, biopsy gun, positioning stage, insertion stage and mount (Fig. 2).

For localisation of tumor suspected areas a standard MR-examination was performed using a combination of an endorectal coil and two CP-body-array coils (one anterior, one posterior). After the examination the endorectal coil was replaced by the biopsy device. The needle guide of the device was filled with a MR-visible fluid to control positioning of the needle using a real-time TrueFisp and a T2-weighted TSE sequence observed with an in-room monitor (Fig. 3). Core biopsies were taken manually in the magnet with the patient in supine position.

Results:

The biopsy needle could be visualized and correctly positioned in all cases. Tumor suspected lesions with a diameter < 10 mm could be sucessfully punctured. Prostate cancer was found by MRI guided biopsy in 33% (n=7), prostatitis in 33% (n=7) and benign prostatic hyperplasia in 33% (n=7). In cases of histological confirmed cancer a good correlation was found between tumor location on the MR-images and tumor location at histology. The whole examination time was between 60 and 90 minutes depending on the number and location of the suspected areas. No complications other than those associated with a standard TRUS-guided biopsy were observed.

Conclusions:

The demonstrated biopsy technique performed with the patient in supine position can be a valuable tool for obtaining MRI-guided biopsies based on MR-images showing suspicious areas, which were not identified on TRUS-imaging.

Referencies:

[1] Landis, Murray,BoldenCA Cancer J Clin 48;6-30,1998. [2] Keetch, Catalona, Smith: J Urol. 151; 1571 1994. [3] Wefer, Hricak Vigneron et al. J Urol164; 4oo-404, 2000. [4] Perrotti, Ken-Ryu-Han, Epstein, J Urol 162;1314-1317, 1999. [5] D`Amico, Tempany, Cormack, J Urol 164;385-387, 2000. [6] Susil, Camphausen, Choyke et al.: Mag. Res. in Med 52, 683-687, 2004.

Fig. 1: View from the rear of the magnet:
All parts assembled together for the biopsy.

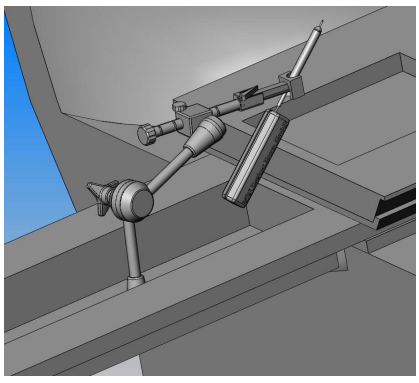

Fig.2: Schematic view of the biopsy device.

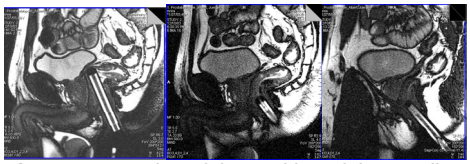

Fig. 3a: Correction of the position of the needle guide using a real time TrueFisp sequence

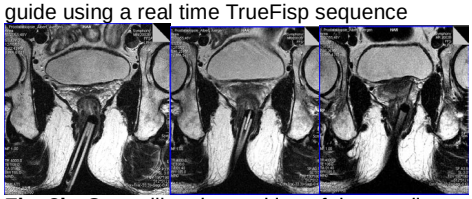

Fig. 3b: Controlling the position of the needle guide using a TSE-sequence and a coronal slice orientation..