Magnetic Resonance Image Guided Biopsy in Prostate

Ronald D. Watkins, Kenneth W. Rohling, Egidijus E. Uzgiris
Charles L. Dumoulin, Robert D. Darrow, Randy O. Giaquinto
General Electric Research & Development, Schenectady, NY 12309

Purpose

The purpose of this study was to develop an MR Image Guided Biopsy device using MR Tracking (1)for real time control of image scan plane. Under guided scan control a Biopsy needle can be guided to a local target.

Introduction

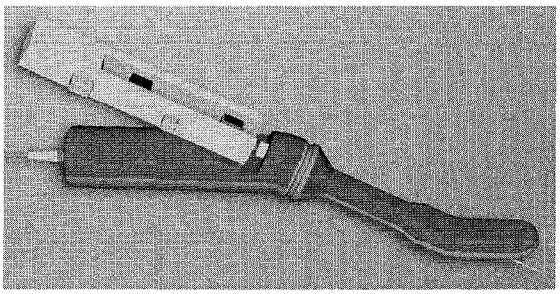
MR Imaging with an endo rectal coil provides high sensitivity, high resolution images of the prostate (2,3) The current standard for a biopsy of the prostate is TRUS. (Transrectal Ultrasound Guided Biopsy). TRUS often cannot reliably differentiate normal tissue from BPH and prostatic cancer. We propose the use of MRI as a means to localize suspected lesions and guide a biopsy needle for improved accuracy.

Methods

A probe shell was designed by 3-D solid model. This model was used to produce a prototype part using a stereo lithography. Inside the probe shell is a 20mm by 70mm surface coil. Also in the probe, is 3 tracking coils 2mm dia. 4mm length co-planer with the sagital plane of the imaging coil and the biopsy needle guide. The 3 tracking coils contain small samples of CuSo4 in water. These 3 samples are used with a tracking sequence to prescribe an imaging plane in which the biopsy needle guide is contained. A pulse sequence locates coordinates of each tracking coil and then prescribes a scan plan containing these coordinates. This allows one to manipulate the handheld probe and have the scan plane follow the FOV of the imaging coil.

The probe was connected to a commercial MRI scanner, (GE Signa 1.5T), with custom hardware and software added to support the device tracking.

The Probe



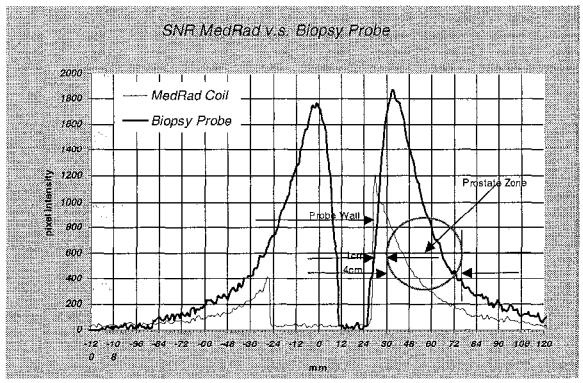
Pulse Sequence

A custom pulse sequence has been developed that will locate 3 tracking coils and prescribe a image scan plane that contains the 3 coils(1). A Spin Echo imaging sequence was used with the following parameters:

TR/TE: 500ms/20ms FOV: 24cm X 24cm
Resolution 256 x 256 1.5mm slice

Results

The probe produced images that followed the scan plane containing the 3 tracking coils and CuSo4 samples. The same scan plane also contains the trajectory of the biopsy needle guide. SNR was compared to a commercially available endorectal coil (MedRad, Pittsburgh, Pa.). The average SNR was 2.5 times higher than the commercial coil.



Discussion

We have demonstrated an endorectal imaging device capable of realtime control of an MRI scan plane and contains a high sensitivity intracavitary surface coil. The device could be used to guide a bipsy needle to a local target volume. The device could also be used to deliver therapy such as laser energy (4) or brachytherapy (5).

References

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