AbstractID: 1989 Title: Feasibility of Prostate Cancer Localization Using a Novel Ultrasonic Tissue-typing Technique

Feasibility of Prostate Cancer Localization Using a Novel Ultrasonic Tissue-typing Technique

The objective of this research is to demonstrate the feasibility of using an ultrasonic tissue-typing technique (spectrum analysis) to localize cancerous regions inside the prostate. Our ultrasound spectrum technique analyzes the raw radio-frequency ultrasonic signals and extracts spectral parameters that are associated with physical properties of tissue microstructures. A theoretical model is developed to relate these measured spectral parameters to tissue microstructure properties such as size, shape, orientation and acoustic impedance (stiffness). Ten patients with localized prostate cancer were enrolled in an initial study. *In vivo* 3-D prostate ultrasound radio-frequency (RF) data were acquired in a sequence of parallel scans, which were 1 mm apart with a B & K transrectal ultrasound. The RF data were analyzed using a 2-D Fourier spectrum algorithm. The resulting spectral parameters were computed to quantitatively assess the prostatic tissues. Prostate needle biopsies were used as the gold standard. We analyzed 20 cancerous regions vs. 20 non-cancerous regions. The size of each region analyzed is 4 mm x 4 mm. Significant differences were found in three 2-D ultrasonic parameters ($p < 0.001$): peak value of radially-integrated spectral power (RISP), slope and intercept of angularly-integrated spectral power (AISP). Initial studies demonstrated the feasibility of clinically employing this ultrasonic tissue-typing method for segmenting cancer-bearing regions inside the prostate. We are investigating this ultrasonic tissue-typing technique in guiding dose escalation in treatment planning of prostate cancer brachytherapy and IMRT.