

AbstractID: 5083 Title: Segmentation of radioactive seed in 3D ultrasound images for intraoperative LDR prostate brachytherapy

**Purpose:** Develop and evaluate an algorithm to automatically localize implanted radioactive seeds in 3D ultrasound images for dynamic intraoperative low dose rate (LDR) brachytherapy procedures, in which all phases of the procedure are performed in one session to deal with variability in the current prostate brachytherapy.

**Method and Materials:** Intraoperative seed segmentation in 3D TRUS images is achieved by performing a subtraction of the image before the needle has been inserted, and the image after the seeds have been implanted. The seeds are searched through a thresholding operation in a “local” space determined by the needle position and orientation information, which are obtained from a needle segmentation algorithm. To test this approach, 3D TRUS images of the agar and chicken tissue phantoms were obtained. Within these phantoms, dummy seeds were implanted. The seed locations determined by the seed segmentation algorithm were compared with those obtained from a volumetric cone-beam flat-panel micro-CT scanner and human observers.

**Results:** Evaluation of the algorithm showed that, the *rms* error in determining the seed locations using the seed segmentation algorithm was  $0.98mm$  in agar phantoms, and  $1.02mm$  in chicken phantoms. In both agar and chicken phantoms, 100% of the implanted seeds were correctly identified using the seed segmentation algorithm.

**Conclusions:** The seed segmentation algorithm is insensitive to different materials, as the errors of the algorithm are almost the same in agar and chicken phantoms. This work indicates the potential to achieve an intraoperative post-implant dosimetry. Integration of this algorithm into a clinical brachytherapy system is now ongoing and clinical testing with patients will take place in the near future.