dosimetric images and reconstruction of the series of planar angle dosimetric images.
Conclusions: This novel approach and system will support the development of new medical procedures for the realization of patient specific plaques with customized dose distribution for each unique tumor.

PROSTATE POSTERS
Thursday–Saturday

PO22

A Novel Method to Register Post-Implant Magnetic Resonance Imaging to Pre-Plan Ultrasound Images to Evaluate Needle Passage through Neurovascular Bundles during Permanent Prostate Implant

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Purpose: Transrectal ultrasound (TRUS) is the most common image modality used in permanent prostate brachytherapy (PPI). Although providing excellent prostate visualization, TRUS images are inferior to MRI images for identifying critical structures such as neurovascular bundles (NVB). To preserve erectile function after PPI, the traumatic injury resulting from needles passing through NVB is worth investigating. Our goals were to develop a novel method to register post-implant MRI to pre-plan ultrasound (US) images and demonstrate its usage on evaluating needle passages to NVB.
Materials and Methods: A series of transverse TRUS images of prostate and several non-isocentric C-arm fluoroscopy (FL) images are taken intraoperatively right after PPI. The registration of post US images and reconstructed 3D seed cloud from FL images (seeds_FL) will be used as a bridge to register post MRI to pre US images. The Registration of Ultrasound and Fluoroscopy (RUF) images is done by an intensity-based point to volume algorithm. A 1D scaling factor along anterior-posterior direction is used to account for prostate deformation with presence of ultrasound probe. The day one post CT and MRI images are co-registered and the 3D seed cloud is segmented from CT (seeds_CT) whereas critical structure contours obtained from MRI (T2). The iterative closest point (ICP) algorithm is used to compute rigid transformation between seeds_FL and seed_CT. All contours from MRI can be transferred to FL coordinate using registration of two seed clouds and then to US coordinate using RUF registration. Because the intraoperative pre-US images share the same coordinate with post US images, the post MRI is then registered to pre-US after this two step transformation. To demonstrate this registration method, post MRI from twelve patients (mean prostate volume 34 $\pm$ 9 cc, only intraprostatic seeds implanted with parallel needles) were registered to pre-US. The prostate, urethra, rectum, penile bulb and NVB contours obtained from MRI were overlaid on US images. The overall registration accuracy was evaluated by comparing prostate, urethra and rectum contours from both data sets. The planning needle interferences with NVB were investigated.
Results: After registration, in 8 of 12 patients, the prostate base, apex and center of mass of both prostate and urethra match very well (<0.3 cm) between two contour sets. The anterior surface of rectum matches well within these 8 patients too. Large rotational errors (>10$\underline{o}$) presented for two cases due to failure of the ICP algorithm, and about 1 cm base to apex direction offset presented in another two cases mostly due to offset in RUF registration. The penile bulb contours from two data sets generally off 1 cm which shows our registration method only works with structures close to prostate since seed locations in prostate was part of registration algorithm. When planning needles were superimposed over contours, there were about 3-4 needles passing through or in close vicinity of each NVB in all patients. The needles and NVB interference mostly happens under apex part of prostate.
Conclusions: A novel method to register post-implant MRI to pre-plan US images was developed and demonstrated in accessing needle passages to NVB during PPI. The pattern of needle and NVB interference obtained can be used to design generic non-parallel implant technique to avoid traumatic injury to NVB. The registration information from fusion of post-implant MRI and preplan US can also provide insights to develop robust registration method between pre-implant MRI and US without using seeds as the bridge.

PO23

Comparison of Treatment Plan Parameters in Brachytherapy of Prostate Cancer in Different Schedules

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Purpose: Radiotherapy (EBRT and HDR-BT) in prostate cancer treatment seems to be nowdays as effective as surgery procedure. High-dose-rate brachytherapy (HDR-BT) can be applied as a single modality treatment in patients from low- and intermediate-risk group with localized tumors. High-dose-rate brachytherapy (HDR-BT) is very usefull in high-risk group patients, in increasing prostate dose after EBRT (boost) which shortens whole radiation treatment. There are no clear recommendations about doses and schemes of combined radiation treatment (EBRT-BT). The aim of this work was to make comparison of dose-volume parameters beetween (HDR-BT) fractions, in patients prostate cancer treated in two combined with external beam radiotherapy schedules and one monotherapy.
Materials and Methods: One hundred three patients were enrolled to the study and divided to groups according to radiation schemes (I – EBRT 50 Gy/BRT 1 x 15 Gy, II – EBRT 46 Gy/BRT 2 x 10 Gy, III – BRT 3 x 15 Gy) Group I, II, III consisted of 37 (35.92%), 36 (34.95%), 30 (29.13%) patients, respectively. HDR-BT was performed with a remote afterloading microSelectron unit (^{192}Ir source) after planning procedure (SWIFT and Oncentra system). The mean value of D90 (reference dose given to 90% of volume) was 90.86%, 88.23% and 92.03%, respectively, to each group. Hot spots parameters in target volume (V200, V150, V120, Dmax) were found respectively: I – 15.22%, 41.48%, 69.47%, 1192.46%, II – 16.31%, 40.09%, 66.61%, 1906.19%, III – 14.97%, 39.3%, 67.53%, 1182.16%. Mean urethral D10 (dose given to 10% of urethral volume) was established on respectively: 122.32%, 123.48% and 120.37%. Mean values of high doses parameters for urethra (Dmax, V100, Dmean) were as follows respectively for I group: 143.18%, 53.76%, 90.23%, for II: 144.7%, 53.76%, 97.34% and for III: 140.79%, 46.57%, 86.79%. Mean rectal D10 dose was estimated as 62.19% (I), 63.8 (II), 65.21% (III). According to parameters Dmax (90.76% - I, 90.85% - II, 84.68% - III), V100 (0.43% - I, 0.23% - II, 0.18% - III), Dmean (46.06% - I, 46.27% - II and 49.35% - III) were found as a hot spots in rectum volume. The doses values were presented as a percent or biologic effective dose in Gy. Comparison of dose-volume parameters was done by Kruskal-Wallis and Mann-Whitney tests.
Results: After statistical comparison we observed higher values of high target doses (V200, Dmax) in the second group of patients. Parameter V120 was the only one with statistical significance in Kruskal-Wallis test (p=00264). According to these changes, parameters of target doses like D90 (87.76%) and V100 (82.5%) were lower in II than the other groups (without statistical significance). The urethral high dose-volume parameters were much higher in 46/ 2 x 10 Gy group - D10 (123.48%), Dmean (97.69%), V100 (54.2%), also without statistical significance. In the second group parameter Dmax (90.95%) for another organs at risk (rectum) was the highest and with smallest value of SD parameter (10.83%) can increase risk of serious complications in this localization.
Conclusions: HDR brachytherapy parameters in prostate cancer treatment are not statistically different in most treatment schedules. HDR brachytherapy schedule with two lower doses fractions was less correct in terms of treatment planning system constraints.

PO24

A Comparison of AUA Symptom Scores following Permanent Low-Dose-Rate Prostate Brachytherapy with Iodine-125 and Cesium-131

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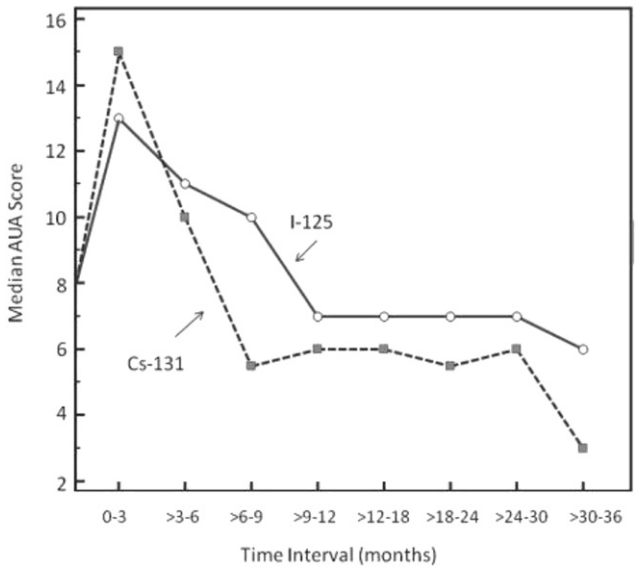
Purpose: To assess whether radioisotope selection alters pattern of urinary morbidity after PBT.
Materials and Methods: Since 1999 York Hospital has performed PBT with ^{125}I, and in 2007, with Cs-131. A computerized prospective database

containing demographic, treatment, and followup data, including AUA (American Urological Association) score of urinary function, has been maintained. For this report the database was searched for patients who had a minimum of two followup AUA scores in addition to a pretreatment AUA score (3 minimum). In order to eliminate any time bias based on the earlier nature of the ^{125}I cohort, only AUA scores obtained within 36 months from implant date were considered. Delta-AUA was defined as the followup AUA score minus the baseline AUA score. The largest delta-AUA was considered the ''peak AUA score'' and was used to compare the severity of post-implant urinary dysfunction in patients undergoing implantation with either ^{125}I or Cs-131. A total of 726 followup AUA scores were obtained for 212 patients. Furthermore, time course for resolution of urinary side effects was evaluated. Only one AUA score per patient per interval was considered, with only the earliest AUA score considered when a patient had more than one score in an interval. A total of 659 AUA scores were used to construct Figure 1.

Results: Mean number of followup AUA scores, mean followup AUA score per patient and mean followup interval did not achieve statistical significance. Figure 1 depicts the median AUA score per time interval obtained from the ^{125}I cohort (72 patients) and Cs-131 cohort (140 patients). All AUA profiles peaked and returned toward baseline over time following implant (Figure 1). While the mean peak delta-AUA score was slightly higher for patients treated with Cs-131, the comparison to those treated with ^{125}I was not statistically significant ($p=0.2$). The mean time of the peak delta-AUA score occurred 2.6 months earlier in the Cs-131 treated cohort ($p=0.037$).



Conclusions: Our data suggest that shorter half-life of Cs-131 versus ^{125}I (10 versus 60 days) results in a more rapid resolution of urinary side effects and lower intensity of urinary morbidity beyond the initial three months.

PO25

Biochemical Outcomes in Patients with Gleason Score 9 or 10 Adenocarcinoma of the Prostate from a Single Institution

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Purpose: The optimal treatment of patients with Gleason score 9 or 10 prostate cancer is debated within and between specialties, as reflected in variable PSA outcomes for data reported. We present our clinical outcomes in irradiated patients for this population.

Materials and Methods: With approval of our institutional protocol and ethics panel, prospectively collected patient, disease, treatment, and biochemical data were analyzed in patients with Gleason score 9 or 10 prostate cancer treated by a single physician (DS) at Beth Israel Medical Center (New York, NY) from 1997 to 2012. External beam radiation therapy (EBRT) was delivered using 15 – 18 mV photons to an initial portal including prostate, seminal vesicles and draining pelvic lymph nodes to 45 Gy, followed by a conformal cone down to 50.4 Gy, then a boost with either brachytherapy or 30.6 Gy conformal EBRT. PSA was routinely checked every 6 months in followup after treatment was completed. Biochemical failure (BF) was defined as post-treatment PSA nadir + 2 ng/mL.

Results: Forty-five patients with Gleason score 9 or 10 prostate cancer underwent curative intent irradiation. Ninety-three percent (N=14 GS 4+5, N=12 GS 5+4, N=9 GS 9) of patients had Gleason Score 9 disease. Thirty-eight percent of patients were Hispanic, 36% African American, 20% Caucasian, and 7% Asian. The median patient age, PSA, and T stage were 68 years (range 48-80), 17 ng/mL (range 2.3 – 280), and stage III (20% T1, 16% T2, 38% T3a/b, 18% T3c). Combined EBRT and permanent radioactive seed implant (CMT) was used in 67% (N=30); EBRT alone was used in 29% (N=13); brachytherapy alone was used in 4% (N=2). Hormonal therapy (HT) was administered to 98% (N=44) of patients, and was used for a median duration of31 months. Of the patients receiving brachytherapy as part of their treatment, 75% (N=24) received an ^{125}I permanent seed implant and 25% (N=8) received a ^{103}Pd implant.

With a minimum followup of 2 years and a median followup of 4.3 years (range 2.0-12.0), overall biochemical failure was 22.2% (N=10), and median time to failure was 4.6 years (range 2.8 – 7.1 years). Of those that failed, median age was 67 (range 53-80), and 50% were African American; median pre-treatment PSA was 32 ng/mL (range 2.2 – 57.7), median AJCC stage was 3. BF occurred in 6/30 (20.0%) CMT patients (3/6 ^{125}I and 3/6 ^{103}Pd), and 3/13 (23.1%) EBRT patients. All patients who failed received HT.

Conclusions: Our data demonstrate excellent overall biochemical outcomes in patients with Gleason score 9 or 10, with only approximately 22% of patients experiencing BF at a median followup of 4.3 years. Gleason 10 patients did not appear to have worse outcomes compared to Gleason 9 patients. Of all treatments analyzed, combined EBRT and permanent seed implant yielded the highest rate of biochemical control. Further prospective analyzes comparing EBRT +/- brachytherapy in this population are warranted.

PO26

Permanent Prostate Brachytherapy for Organ Confined High-Risk Prostate Cancer Patients

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Purpose: To overview initial 9-year experience of permanent prostate brachytherapy (BT) in a single institute in Japan and evaluate the effectiveness of the treatment especially on high-risk cases.

Materials and Methods: Twelve hundred ninety-four patients with clinically localized prostate cancer were treated with BT from September 2003 to September 2010 and followed for at least 24 months (24 to 109 median 65.5 months). Among those 1294 cases, Gleason Score (GS) <7 was 47.4% (n=613), GS=7 was 46.5% (n= 602), GS≥8 was 6.1% (n=79). Initial prostate-specific antigen (iPSA) level ≤10ng/mL was 70% (n= 939), 10-20ng/mL was 22.6% (n=292), and >20ng/mL was 4.9% (n=63). Clinical stage T1c was 60.4% (n=781), T2 was 38.6% (n=499), and T3 was 1.1% (n=14). All the cases were treated with iodine-125 seed implantation with or without external beam radiotherapy (EBRT). Sixty-four percent of the cases had had hormone therapy before seed implantation mostly to reduce prostate volume. Cases with low-risk disease (NCCN definition: PSA <10ng/mL and GS <7 and <T2c) and some of intermediate-risk cases (PSA <10ng/mL and GS <3+4 with positive biopsy core rate <34% and <=T2c) were treated with seed