

significantly different with I-125 than with Pd-103. It has been our impression, for instance, that intra-prostatic under-dosed regions are less common with I-125. If so, using isodose patterns intra-operatively to identify an inadequate V100 or D90 may be less useful. In order to further develop our intra-operative post-implant dosimetry capabilities, we reviewed 107 consecutive I-125 patients to correlate isodose patterns with sub-optimal dosimetric coverage.

Materials and Methods: The 107 patients reported here were treated consecutively at the Puget Sound VA on a randomized protocol. Patients implanted from June, 2001 through June, 2002 were studied. Implants were performed by standard techniques, using a modified peripheral loading pattern. Dosimetric parameters analyzed included the V100—the percent of the post-implant prostate or rectal volume covered by the prescription dose, and the D90—the dose that covers 90% of the post-implant prostate volume. Isodose patterns were analyzed at mid prostate, and for the entire prostate. Isodose gaps, holes, islands were defined as illustrated in Figures 1–3. *Sensitivity* is defined as the number of patients with an inadequate V100 who have an adverse isodose event divided by the total number of patients with an inadequate V100. *Specificity* is defined as the number of patients with an adequate V100 who do not have an adverse isodose event divided by the total number of patients with an adequate V100. *Positive predictive value* (PPV) is defined as the true positives divided by the total number of positive tests (true positives/[true positives plus false positives]). *Negative predictive value* (NPV) is defined as the number of true negative tests divided by the total number of negative tests (true negatives/[true negatives plus false negatives]).

Results: Of the 107 patients studied, five had a V100 <80%, 21 had a V100 of 80–90% and 85 had a V100 >90%. Isodose gaps were most frequent and most useful in screening for inadequate V100s. Mid-prostatic isodose peripheral gaps >1.0 cm were seen in all of the 5 patients with V100 <80%, 5 of 21 of patients (24%) with a V100 of 80–90%, and 5 of 85 patients (6%) with a V100 >90%. When analyzing the entire prostate, peripheral isodose gaps >1.0 cm were seen in all 5 patients with a V100 <80%, 81% of patients with a V100 of 80–90%, and 26% of patients with a V100 >90%. Midprostatic isodose islands were seen in only one patients, who had a V100 of 60%. Islands anywhere within the prostate were seen in 2 of 5 patients (40%) with a V100 <80%, 5 of 21 patients (24%) with a V100 of 80–90%, and 1 of 85 patients (1%) with a V100 >100%. Isodose holes anywhere within the prostate were seen only in two patients, who had V100s of 75% and 85%. The likelihood of an inadequate V100 was moderately well predicted by the presence of isodose gaps at mid-prostate. Patients with a gap had a 33% chance of having a V100 <80% and a 67% chance of having a V100 <90%. The sensitivity of a mid-prostate gap to predict a V100 <80% was 100%, while the specificity was 91%. The sensitivity of a mid-prostate gap to predict a V100 <90% was only 38%, while the specificity was 94%. If the entire prostate was screened for gaps >1 cm, the sensitivity for a detecting a V100 <90% increased to 85%, but the specificity fell to 74%.

Discussion: We have shown here that with a modified peripheral seed loading placement, peripheral isodose gaps >1.0 cm are characteristic of low V100s in patients treated with I-125, all patients with a V100 less than 80% show a marginal gap >1.0 cm. Considering the high sensitivity and specificity of peripheral gaps as indicators of a low V100, these semi-quantitative findings can provide substantial practical guidelines for intra-operative dosimetry, to provide a more rational guide to intra-operative post-implant assessment and modification. Future work regarding the interpretation of adverse isodose patterns should explore the use of D90 versus V100, and how much of the prostate needs to be analyzed routinely

(i.e.: mid slice, central one-third, central two-thirds, etc.) Another area in need of clarification is the effect of post-implant image acquisition timing on adverse isodose patterns versus QA parameters. In contrast to our previously reported findings with Pd-103, isodose holes or islands were seldom seen with I-125, presumably due to less rapid dose fall-off. This difference in the likelihood of adverse isodose patterns means that the use of isodose patterns to guide intra-operative implant assessment will likely be substantially different for each isotope.

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A comparison of permanent brachytherapy (BT) and 3D conformal radiation therapy (3DCRT) for localized prostate cancer

J. Michalski, D. Mansur, J. Escobar, M. Lockett, C. Perez

Washington University School of Medicine, Mallinckrodt Institute of Radiology, St. Louis, Missouri, U.S.A.

Purpose: A comparison of patients treated with permanent brachytherapy (BT) or 3D conformal radiation therapy (3DCRT) for localized prostate cancer was performed.

Methods and materials: The records of 519 patients treated with definitive radiation therapy between 1997 and 2001 in our department for localized prostate cancer were reviewed. 138 patients are excluded from this report due to use of hormones (120), non-3D CRT (10), or missing initial PSA (8). 207 patients were treated with BT and 174 patients with 3DCRT. The average age of patients getting BT was 68y and 3DCRT was 70y. Patients were stratified according to risk by GS, PSA and clinical stage by previously established risk groups with low risk patients having GS=<6, initial PSA=<10 and T1-T2b. Intermediate risk patients had one feature worse than this and high risk patients 2 features worse than this. Brachytherapy dose prescriptions were according to published American Brachytherapy Society guidelines. Patients undergoing BT also received 45Gy EBRT if they had intermediate or high risk disease. 3DCRT patients were treated with conventional fractionation to a median dose of 74Gy. Of the 174 patients treated with BT, 165, 33, and 9 were low, intermediate, and high risk, respectively. Of the 207 patients treated with 3DCRT, 103, 40, and 31 were low, intermediate, and high risk, respectively.

Results: At 3years the overall survival was 100%. Using ASTRO criteria for biochemical failure, the 3 year bNED survival was 91% and 95% for low risk (p=0.73), 78% and 97% for intermediate risk (p=0.54), and 100% and 74% for high risk patients (p=0.55) receiving BT or 3DCRT, respectively.

Conclusions: BT and 3DCRT show equivalent outcomes for patients with localized prostate cancer.

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¹⁹²Ir LDR Brachytherapy(BT) is at least as efficient as HDR options for boosting intermediate or unfavourable prostate cancers after EBRT. Experience on 201 patients

P. Nickers, N. Jansen, B. Thissen, J.M. Deneufbourg

University Hospital of Liège, Radiation Oncology, Liège, Belgium

Material and methods. Between 01/1997 and 12/2001, 201 patients were treated with EBRT and BT boost. The latter included 4 to 8 lines implanted following the principles of the Paris System. The majority of implants included a central square of 2.0-2.2 cm side. In function of the volume of the prostate, 2-4 additional lines were placed laterally in triangular shapes. Catheters were inserted manually without template, under endorectal echographic control to avoid pelvic bone arch or prostate volume interference. The optimization of the

delivered dose was based on the rules of the Paris System and a selective loading of ^{192}Ir wires thereafter. This LDR BT (± 15 Gy/day) intended to deliver 40-45 Gy to the CTV after pelvic EBRT of 40 Gy.

Results. The median age of patients at diagnosis is 70,3 years. The median follow up time is 3,5 years. Tumors were classified in intermediate ($n=64$) or unfavourable ($n=137$) prognosis categories when they included respectively only one or at least two of the following criteria: PSA $>10\text{ng/ml}$, Gleason Score >6 , T $>2a$ (UICC2002). The median PSA value at diagnosis was 14 ng/ml. The median Gleason score value was 6 and the median T value was T2c. 33 patients reported a TURP. 103 patients received simultaneous hormonotherapy during 3-6 months depending on referring urologists. The combined total dose to the CTV was $82\pm 3,4$ Gy. 5 y bNED is 82,8 % for the whole population and respectively 96,9 % and 75,8 % for intermediate and unfavourable prognosis categories. In the population without hormonotherapy, PSA nadir ≤ 1 ng/ml and $\leq 0,5$ ng/ml were achieved in respectively 80 % and 76 % of cases. In univariate analysis, Gleason score and T classification were the only significant factors to predict a biochemical control. Preoperative PSA values were at the level of borderline significance but hormonotherapy was not. In multivariate analysis, Gleason score ($p=0,0018$) and T classification ($p=0,0028$) remained significant. The rate of grade II rectal complications was 4 % and no grade III toxicity was recorded. Urinary complications of grade II and III appeared in respectively 6,5 % and 6 % of patients. Previous TURP was a powerful predictor of urethral toxicity ($p=0,0003$). In the beginning of the study one bladder grade IV late side effect needing surgery was recorded.

Conclusion. With respectively $>96,9$ % and $>75,8$ % 5 y bNED for intermediate and unfavourable prognosis categories, our method is simple but at least as efficient and safe as the methods described by Martinez et al., and Kovacs et al., using EBRT and a HDR BT boost. So the argument usually advocated to favour the HDR due to an α/β ratio around 1,5 Gy for prostate tumours is only one of the explanations of the efficacy of BT in these tumours. The results achieved by the present work should encourage the actual development of new radioisotopes, delivering higher dose rates than those from actual permanent implants and allowing to cover the CTV with a smaller number of sources.

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Comparison of race and prostate cancer outcome in patients treated with brachytherapy

M. Kollmeier¹, J. Cesaretti¹, D. Huang¹, N. Stone², R. Stock¹

¹Mount Sinai School of Medicine, Radiation Oncology, New York, NY, U.S.A.

²Mount Sinai School of Medicine, Urology, New York, NY, U.S.A.

Introduction and Objective: To analyze the significance of race on biochemical outcomes in patients with prostate cancer treated with brachytherapy.

Methods: 1,024 consecutive patients with clinically localized prostate cancer underwent prostate brachytherapy (PB) \pm external beam radiation therapy (EBRT) between June 1990 and October 2001. All patients were followed with serial PSAs for a minimum of 2 years postimplant. Follow-up ranged from 24 to 150 months (median 53). 831 Caucasian (C), 130 African-American (AA) and 63 Hispanic (H) patients were identified. Disease stage was $\leq T2a$ in 62% in the C, 64% in the AA, and 49% in the H cohort. Gleason score was ≤ 6 in 72%, 68%, 62% of the C, AA, and H groups, respectively. Initial PSA was >20 ng/mL in 7% of C, 24% of AA and 19% of the H patients. 636 (77%) C, 42 (67%) H, and 80 (62%) AA patients underwent PB

without EBRT. Optimal dose groups were defined according to D90 (dose to 90% of the prostate volume) as follows: full implants (I-125 ≥ 140 Gy; Pd-103 ≥ 100 Gy) and for partial implants (I-125 ≥ 94 Gy; Pd-103 ≥ 90 Gy). Hormone therapy was used in 52% of C patients, 57% of AA patients, and 54% H patients. Biochemical failure was defined using the ASTRO definition.

Results: The actuarial 7-year biochemical freedom from failure (bFFF) for the entire group was 82% ($n=110$). For each group, the 7-year actuarial bFFF was 84%, 79% and 58% in the C, AA, and H groups, respectively ($p=0.66$). The 7-year bFFF for C, AA, and H groups according to risk categories were as follows: low risk patients (Stage $\leq T2a$, Gleason ≤ 6 , initial PSA ≤ 10 ng/mL): 92%, 87% and 85% ($p=0.21$), intermediate risk patients (Stage T2b or Gleason=7 or initial PSA $>10.1-20$ ng/mL): 84%, 76% and 76% ($p=0.10$), and high risk patients (≥ 2 moderate risk features or $\geq T3$, Gleason ≥ 8 or initial PSA >20 ng/mL): 72%, 78%, and 67% ($p=0.76$). In patients who received optimal dose implants, the 7-year bFFF was 88% in the C group, 79% in the AA group and 85% in the H group ($p=0.30$). A significantly greater proportion of patients presented with higher initial PSA values ($p=0.002$). There were no significant differences in bFFF based on PSA, stage, Gleason score, isotope, use of EBRT or hormone therapy with respect to racial group on univariate or multivariate analyses.

Conclusions: AA and Hispanic men with prostate cancer present with higher risk features, particularly higher initial PSAs than Caucasian men. However, when patients are stratified by risk group there appeared to be no significant difference in overall outcome based on race. PB appears to be equally effective across these three racial groups.

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Permanent prostate implant using high activity seeds and inverse planning with fast simulated annealing algorithm: an early Canadian experience

É. Vigneault, A.-G. Martin, L. Beaulieu, J. Pouliot, J. Roy

Centre Hospitalier Universitaire de Québec, Radio-oncologie, Québec, Canada

Purpose: The purpose of this paper is to present the results of the patients with Permanent Prostate Implant (PPI) using high activity seed and inverse planning with fast simulated annealing algorithm.

Methods and material: From June 1994 to January 2002 three hundred and ninety five patients with a localized prostate cancer were implanted at the Hôtel-Dieu de Québec radiation oncology department. High activity (0.76-0.84 U) free seeds in pre-loaded needles were used. Anesthesia was either general, regional or local, to the patient's choice. From the beginning we used for the pre-implant dosimetry an inverse planning algorithm based on fast simulated annealing. The optimized plan covers the prostate gland with a minimal dose of 145 Gy while keeping the urethra D5 below 360 Gy and the rectal D5 under 160 Gy. The PSA failure free survival (FFS) according to the ASTRO consensus definition are presented, as well as the GU and GI acute and late RTOG toxicity grade.

Results: At time of implant, three hundred and twelve patients presented a low risk disease defined by a clinical stage T1 – T2, Gleason score ≤ 6 and pre-treatment PSA ≤ 10 while 75 patients presented a pre-treatment PSA above 10 (high risk group). 11 patients had a Gleason score above 6 and one patient had a stage T3 disease. Patients were followed up to 105 months with a mean follow-up time of 39 months. The 5 years Kaplan-Meier biochemical FFS is 90.7% for the whole population. When stratified by risk factors, the low risk group had a 5 years Biochemical FFS of 91.1% compared to 88.5% for the higher risk group. 59% of our population are free of GU