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Prostate

The impact of trainee involvement on outcomes in low-dose-rate brachytherapy for prostate cancer

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ABSTRACT

PURPOSE: To determine the impact of fellow, resident, or medical student (MS) involvement on outcomes in patients undergoing permanent ^{125}I prostate seed implant.

METHODS AND MATERIALS: The study population consisted of men with clinically localized low/intermediate-risk prostate cancer treated with low-dose-rate permanent interstitial brachytherapy. Cases were stratified according to resident, fellow, MS, or attending involvement. Outcomes were compared using analysis of variance, logistic regression, and log rank tests.

RESULTS: A total of 291 patients were evaluated. Fellows, residents, and MS were involved in 47 (16.2%), 231 (79.4%), and 34 (11.7%) cases, respectively. Thirteen (4.4%) cases were completed by an attending physician alone. There was no difference in freedom from biochemical failure when comparing the resident, fellow, or attending alone groups ($p = 0.10$). There was no difference in V_{100} (volume of the prostate receiving 100% of the prescription dose) outcomes when comparing resident cases to fellow cases ($p = 0.72$) or attending alone cases ($p = 0.78$). There was no difference in D_{90} (minimum dose covering 90% of the postimplant volume) outcomes when comparing resident cases to fellow cases ($p = 0.74$) or attending alone cases ($p = 0.58$). When examining treatment toxicity, fellow cases had higher rates of acute Grade 2 + GU toxicity ($p = 0.028$). With the exception of higher urethra D_{90} among PGY 2–3 cases ($p = 0.02$), dosimetric outcomes were similar to cases with PGY 4–5 resident participation. There was no difference in outcomes for cases with and without MS participation.

CONCLUSIONS: Interstitial prostate seed implants can be safely performed by trainees with appropriate supervision. Hands-on brachytherapy training is effective and feasible for trainees.

Keywords: LDR; Prostate cancer; Resident; Medical student; Training; Brachytherapy

Introduction

Low-dose-rate (LDR) ^{125}I prostate brachytherapy is an established standard of care treatment in the management of patients with low- to intermediate-risk prostate cancer. Recent studies have demonstrated a decreasing trend in the utilization of brachytherapy likely due to the introduction of new technologies, changes in economic incentive, and increasing use of active surveillance (1). As a result, there has been a significant reduction in resident-reported brachytherapy experience during training (2).

Brachytherapy procedures provide an important learning opportunity for radiation oncology resident physicians because of their complexity and intricacy. Therefore, they are an important part of radiation oncology residency. Maintaining patient safety is a critical aspect of these

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Conflicts of interest: None.

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procedures due to the proximity of radioactive sources to sensitive normal organs and the potential for significant complications. Although simulation and training models exist, hands-on experience remains the best means for learning these procedures. Patient trepidation regarding trainee involvement is common due to the belief that this may adversely impact treatment outcomes.

In surgical specialties, multiple series have examined the impact of resident or fellow involvement on outcomes with conflicting reports (3, 4). To our knowledge, there are no studies that have addressed the possible impact of trainee involvement on outcomes in patients undergoing LDR prostate brachytherapy. The objective of this study is to examine how brachytherapy outcomes are affected by resident, fellow, or medical student (MS) involvement.

Methods and materials

Patients

The study population consisted of men with low- to intermediate-risk (T1-2, N0, M0) prostate cancer treated with ^{125}I LDR prostate brachytherapy alone at a National Cancer Institute–designated Comprehensive Cancer Center. Patient demographics, tumor characteristics, and treatment-related information were entered prospectively into an Institutional Review Board–approved database that was maintained and updated by data managers. The collection, storage, and retrieval of data were all done in compliance with the hospital's Institutional Review Board and the Health Insurance Privacy and Portability Act. Risk groups were stratified per National Comprehensive Cancer Network criteria, with low risk comprised patients with clinical stage $\leq$ T2a, prostate-specific antigen (PSA) $<$ 10 ng/mL, and Gleason score $\leq$ 6. Intermediate-risk patients consisted of clinical stage T2b–T2c, PSA 10–20 ng/mL, and Gleason score 7. At our institution, high-risk patients are not offered ^{125}I monotherapy per National Comprehensive Cancer Network guidelines (5).

In addition to clinical criteria, patients offered ^{125}I prostate seed implants at our institution must meet criteria set forth by the American Brachytherapy Society (6). Relative contraindications include large prostate volumes ($>$60 cm^3), high international prostate symptom score ($>$20), history of pelvic radiation, large median lobe, or transurethral resection defects. Patients are also evaluated by a board-certified anesthesiologist and urologic oncologists to evaluate for operative risk before the procedure.

Treatment technique/trainee involvement

Planning and procedure technique have been previously described (7, 8). All patients were treated using a stranded technique in which sleeves containing seeds and spacers were matched to the real-time plan and loaded into the applicator needles. The applicator needles were sequentially inserted under ultrasound guidance using sagittal and axial views. Fluoroscopic examination was performed midway and at the completion of treatment to confirm that no seeds are placed in the bladder or urethra.

At our institution, residents or fellows routinely first assist in procedures, while rotating MSs are second assist. In general, only one resident or fellow is typically involved and MSs are not the only trainee involved. Trainees are closely involved in all aspects of the procedure. This includes driving the ultrasound probe and aligning the prostate position and grid. Typically, trainees place needles which are then verified by the attending physician for placement. If there are multiple trainees involved, participants rotate placing needles which are verified by an attending after each placement. If the trainee is unable to successfully place a needle after multiple attempts, the attending physician will then place the needle. Briefly, the number and activity of ^{125}I seeds for each patient is calculated using an MRI-generated, physician-contoured volume with experience in the procedure and reviewed with at least one other experienced attending physician. All procedures are performed under the supervision of a board-certified radiation oncologist with experience in ^{125}I prostate implants, and all trainees are required to complete the appropriate radiation safety-related training.

During the procedure, patients were placed under general anesthesia in extended dorsal lithotomy position. Intraoperative planning and seed placement is under real-time ultrasound guidance using physician-generated contours of the prostate. A 3- to 5-mm anterior and lateral expansion was applied to the prostate volume to generate the planning target volume used for treatment. A total of 145 Gy (Gy) is prescribed to cover 100% of the prostate volume. Per American Brachytherapy Society guidelines, an acceptable plan must achieve a $D_{90} > 145$ Gy and $V_{100} > 90\%$. Midway through treatment and at the end of treatment, patients undergo fluoroscopic examination to document proper seed placement. Rigid cystoscopy is performed by the urologic oncologist to ensure the absence of needles, seeds, or injury in the urethra or bladder at the end of the procedure. Approximately 4 h after the implant, patients have the foley catheter removed and undergo postimplant CT and MRI to document baseline postimplant dosimetry before discharge. Patients return in approximately 3–4 weeks after implant to repeat the CT and MRI and generate the postimplant dosimetry for confirmation of dosimetric quality indicators and ensure seed stability and prostate dose coverage. Trainees complete postimplant dosimetry contouring which the treating physician subsequently verifies.

Statistical analysis

Trainee involvement was identified by reviewing operative reports from brachytherapy cases. Cases were