LDR Brachytherapy for Localized Prostate Cancer – Five-Year Results

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Abstract

Introduction and Objectives. In 1983, prostate cancer patients were treated for the first time by Holm et al with permanent placement of ^{125}I seeds inserted transperineally directly into the prostate. The objective of this study was to assess the efficacy of brachytherapy with permanent 125I seed implantation for the treatment of localized prostate cancer – long-term results.

Materials and Methods. Between October 2006 and December 2011, a total of 177 patients with prostate cancer were treated with permanent ^{125}I implantation brachytherapy. This technique was applied as monotherapy for 168 patients, who had favorable prognosis according with ABS recommendations (stage T1c-T2a, Gleason < 7, PSA < 10 ng/ml).

Results. Procedure time of 1.5 hours to 3 hours. Indwelling urinary catheter was withdrawn in the second day. Hospitalization period was no longer than 24 hours. PSA values at 6 weeks post-implant decreased with 40% in all patients. At 6 weeks and then at 3 months showed urinary morbidity grade I and II in 30% patients without any rectal toxicity. At the 36-months follow-up, 5 patients reported late rectal toxicity. In 85% of cases the erectile function was acceptable.

Conclusions. Prostate brachytherapy using permanent I-^{125} seed implantation is a viable alternative to radical prostatectomy or external beam radiation therapy for the treatment of localized prostate cancer.

Key-words: brachytherapy, prostate cancer, PSA, external beam radiation therapy.

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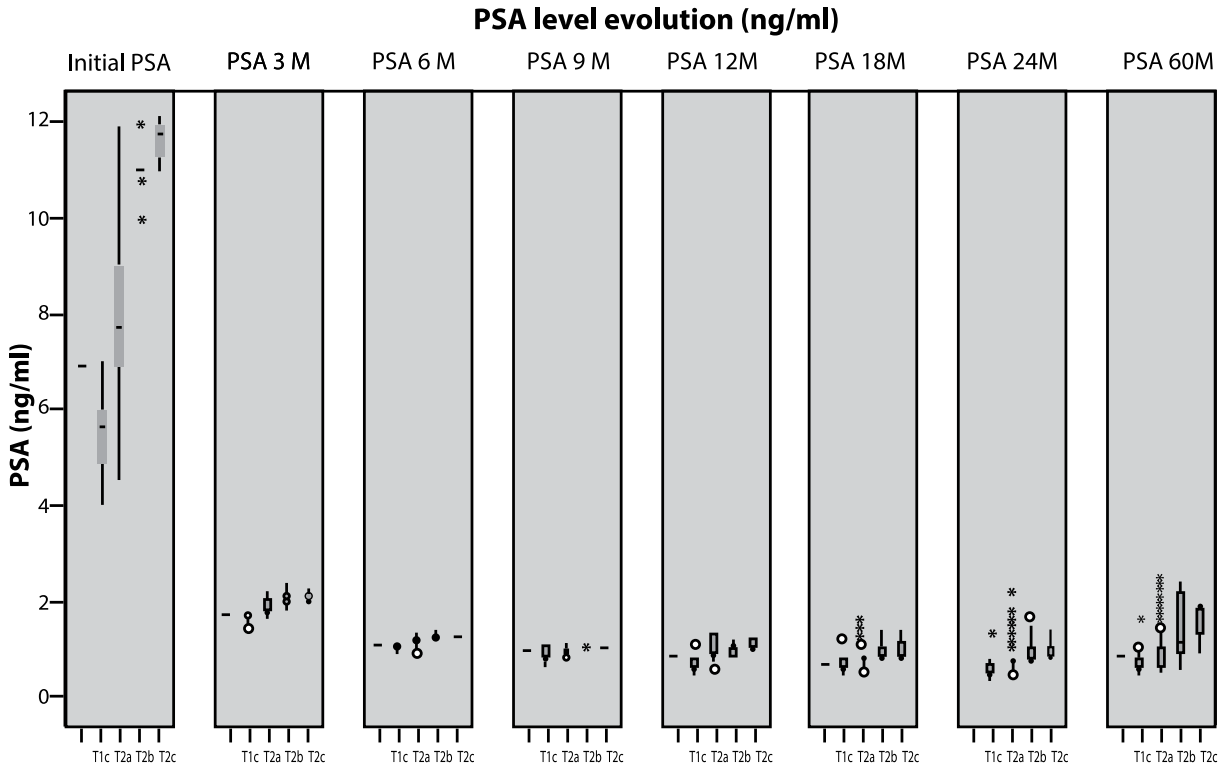
Introduction and Objectives

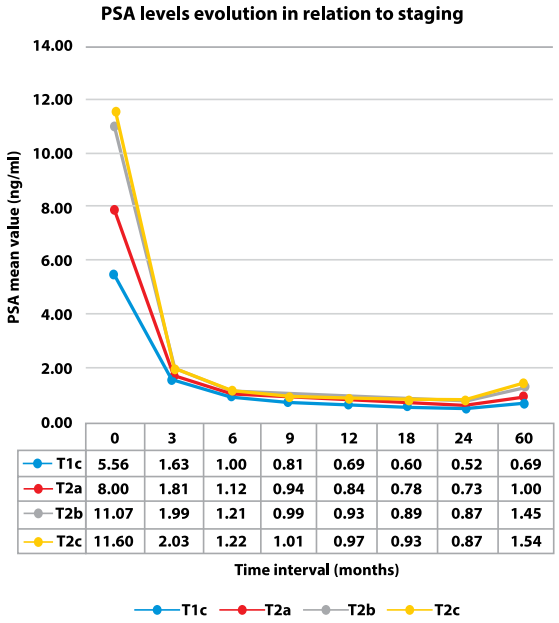
In 1983, prostate cancer patients were treated for the first time by Holm et al with permanent placement of ^{125}I seeds inserted transperineally directly into the prostate. In 1985, Ragde et al introduced the technique of ultrasound-guided prostate brachytherapy with ^{125}I at the Seattle Prostate Cancer Institute. Prostate permanent-implant brachytherapy is a commonly used modality for the treatment of prostate cancer. Its efficacy has been shown to be comparable to either prostatectomy or external beam radiation therapy. Prostate-specific antigen (PSA) is a sensitive measure of outcome after treatment for prostate cancer. After successful surgery, patient's PSA should rapidly decrease to an undetectable level. With either external beam radiation therapy or brachytherapy, however, it may take up to 5 years after treatment to achieve an eventual nadir in PSA. This is because of the slower process of tumor-cell killing with radiotherapy, resulting in a gradual decrease in PSA [1-4].

The objective was to assess the efficacy of brachytherapy with permanent ^{125}I seed implantation for the treatment of localized prostate cancer – long-term results.

Materials and Methods

Between October 2006 and December 2011, a total of 177 patients with prostate cancer were treated with permanent ^{125}I implantation brachytherapy [5]. This technique was applied as monotherapy for 168 patients, who had favorable prognostic according with ABS recommendations (stage T1c-T2a, Gleason < 7, PSA < 10 ng/ml). Brachytherapy iodine implantation followed by external beam radiation therapy was used for 9 patients, with unfavorable prognostic (stage T2b-T2c, Gleason 8-10, PSA > 10 ng/ml) [6]. In all cases, the prostate volume was smaller than 60 cm^3, IPSS < 8, Qmax > 12 ml/s and TUR-P was not performed at least 6 months prior to brachytherapy. Short-term neoadjuvant hormonal blockade (1-3 months) was used to reduce prostate volume in 13 cases and was interrupted post seeds implantation. Transrectal ultrasound-guided prostate brachytherapy with transperineal implantation of ^{125}I was performed in lithotomy position, under general anesthesia. Dosimetric planning of the implant was determined for all patients before seed insertion by computer software (PSID). We used Interstrand sources, with medium activity of 0.708 mCi/seed and total body activity of 35 mCi/patient. The prescribed dose for monotherapy was 145 Gy and the corresponding dose for the combination of brachytherapy with external radiotherapy at 6 weeks post-implantation was 110 Gy. The prostate volume was in average 33.57 cm^3 at the time of implantation. We implanted between 10 and 30 needles, with an average of 16.36 needles and between 22 and 75 sources, with an average of 43.7.



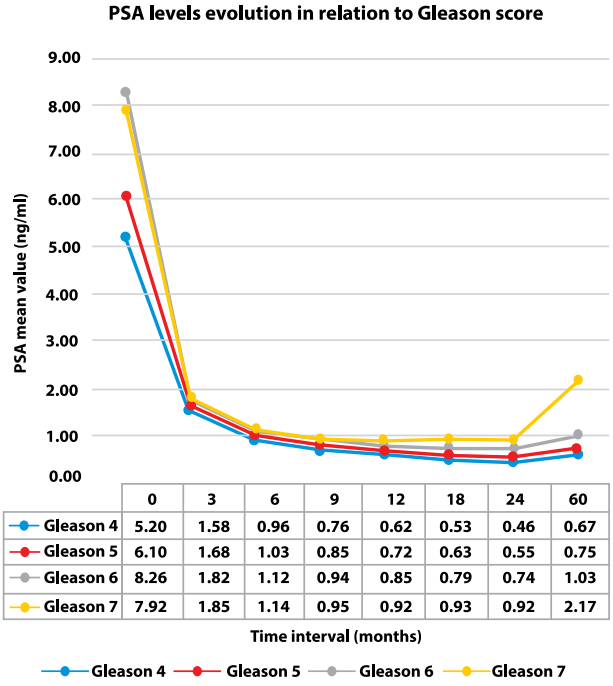


	0	3	6	9	12	18	24	60
T1c	5.56	1.63	1.00	0.81	0.69	0.60	0.52	0.69
T2a	8.00	1.81	1.12	0.94	0.84	0.78	0.73	1.00
T2b	11.07	1.99	1.21	0.99	0.93	0.89	0.87	1.45
T2c	11.60	2.03	1.22	1.01	0.97	0.93	0.87	1.54

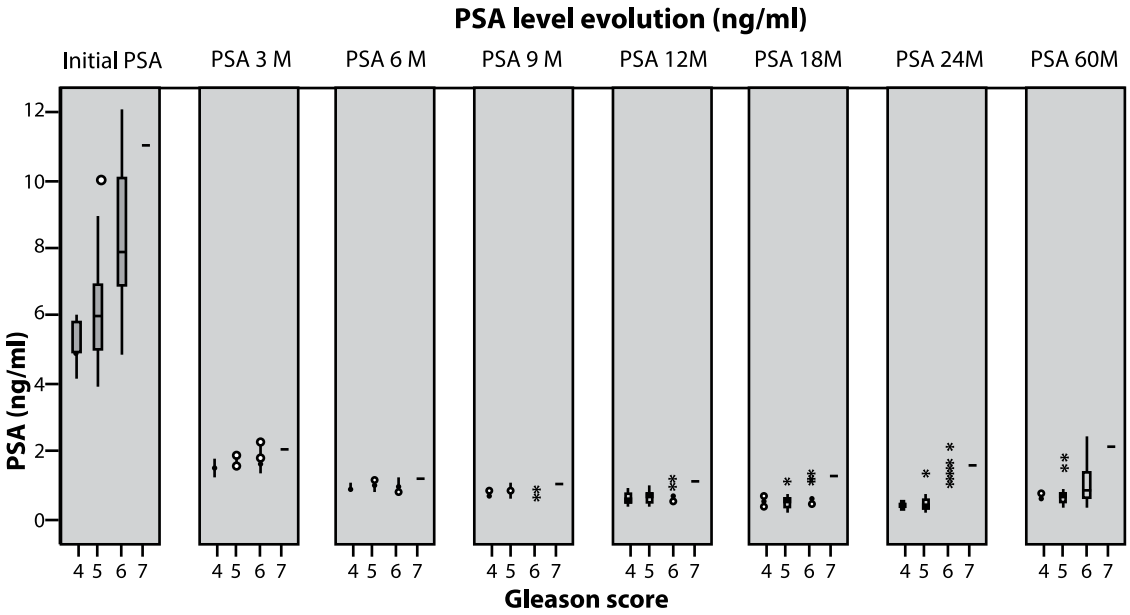
Results

All procedures lasted between 1.5 hours and 3 hours, without further incidents, indwelling urinary catheter was withdrawn in the second day and hospitalization period was no longer than 24 hours. Immediately postoperative, 25% of patients presented irritative voiding symptoms, with 3 episodes of complete urine retention. Computed tomography based dosimetry performed at 6 weeks post-implantation revealed the same prescription dose and insignificant source migration. In addition, PSA values at 6 weeks post-implant decreased with 40% in all patients. Evaluation performed at 6 weeks and then at 3 months, using RTOG scale showed urinary morbidity grade I and II in 30% patients without any rectal toxicity. However, at the 36-months follow-up, 5 patients reported being diagnosed with late rectal toxicity. In 85% of cases the erectile function was acceptable.

In order to evaluate the 5 year efficacy of brachytherapy, the most relevant test is the total PSA. In the following we present the 60-month PSA values, in accordance to initial staging and Gleason score.



	0	3	6	9	12	18	24	60
Gleason 4	5.20	1.58	0.96	0.76	0.62	0.53	0.46	0.67
Gleason 5	6.10	1.68	1.03	0.85	0.72	0.63	0.55	0.75
Gleason 6	8.26	1.82	1.12	0.94	0.85	0.79	0.74	1.03
Gleason 7	7.92	1.85	1.14	0.95	0.92	0.93	0.92	2.17



Discussions

Analyzed from the PSA trend point-of-view, 60-month brachytherapy efficacy was clearly influenced by the initial staging and PSA levels of the patients. Although at the 3-month follow-up all the subjects showed a rapid decrease in PSA values, the trends began to diverge at the 24-month checkpoint. The results were even clearer at the 60-month follow-up, showing an important increase in total PSA (mean > 1.5 ng/mL) in the case of initial T2c staging or Gleason score 7, in opposition with the subjects that had a lower staging and Gleason score before treatment.

Also, the total PSA values for the subjects treated with brachytherapy iodine implantation followed by external beam radiation (9 patients) because of unfavorable prognostic (stage T2b-T2c, Gleason 8-10, PSA > 10 ng/ml), were similar at the 60-month follow-up to those treated with brachytherapy alone, thus validating external beam radiation as a valuable addition in the treatment of patients with more advanced disease [7,8].

The same results were obtained in the case of the 13 subjects who underwent short-term neoadjuvant hormonal blockade (1-3 months).

Conclusions

Prostate brachytherapy using permanent ^{125}I seed implantation is a viable alternative to radical prostatectomy or external beam radiation therapy, for the treatment of localized prostate cancer, but the final outcome is influenced by the initial prognostic criteria, subjects with favorable staging and Gleason score having the lowest PSA levels at 60 moths. It determined an acceptable grade of urinary morbidity (I and II), absence or minimum rectal toxicity and high probability to preserve erectile function, up to 5 years after the procedure. Optimal results are obtained by rigorous patient selection and a multidisciplinary dedicated team (urologist, physicist and radiation oncologist).

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