IPSS and SHIM Score Trends in Prostate Cancer Patients after IMRT: Effects of Pretreatment Urinary Function and Electromagnetic Tracking

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Purpose / Objectives

To compare treatment-related urinary function changes in two groups of patients treated for prostate cancer: patients treated with IMRT in conjunction with Calypso real-time tumor tracking system and patients treated with IMRT utilizing implantable fiducial gold markers with CBCT for image guidance. Simultaneously we described the impact of pretreatment urinary function on post-treatment IPSS trends and evaluate the impact of fractionation regimen on the effects of real-time tracking.

Materials / Methods

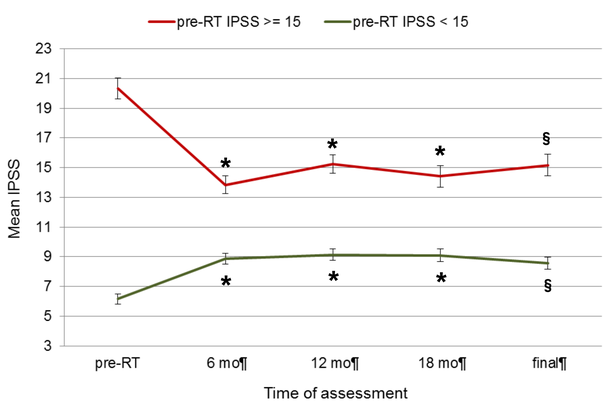
We retrospectively reviewed medical records of patients consecutively treated for prostate cancer between July 2007 and April 2011. We enrolled all patients who were curatively treated with IMRT with either Calypso beacons or gold fiducials. Subjects were treated with either standard or hypofractionated IMRT regimen by the same physician and using the same treatment-planning guidelines. Recorded outcomes: IPSS (primary), nocturia, alpha-blocker use, and Sexual Health Inventory for Men (SHIM) score. Linear mixed models were fit to assess differences by treatment group after adjusting for potential covariates.

Patient Characteristics

Total of 261 patients were enrolled.174 men received Calypso beacons and 87 men - gold fiducials. The first 163 of this cohort received 78 Gy at 2 Gy / fx and the latter 98 received 70 Gy at 2.5 Gy / fx. Except for a higher BMI in the Gold group, there were no significant differences in patient and treatment characteristics between the groups.

The mean pretreatment IPSS was 10.0 (SD = 7.9) in Calypso and 12.6 (SD = 8.4) in Gold cohort. The corresponding median values were 7.0 (0 to 34.0) and 11.0 (0 to 30.0). 27% of Calypso men and 42% of Gold men had pretreatment IPSS ≥ 15.

IPSS Trends by Pretreatment Urinary Symptom Severity



Median time of final follow-up was 27 months.

IPSS trended up in patients with good to moderate urinary function at baseline, while it decreased in subjects with moderate to severe pre-RT symptoms.

The mean values of the groups differed by over a half pretreatment SD throughout the follow-up.

Figure 1. IPSS trends by pre-RT urinary function (all 261 patients). Variance within both groups was significant (Greenhouse-Geisser, $p < 0.001$). The bars represent standard errors. Data points that differed significantly (at $p < 0.01$ to account for Bonferroni adjustment) from pre-RT values are marked with asterisks (*), and data points at which $p = 0.02$ are marked with section marks (§). Paragraph symbols (¶) designate time points at which mean scores differed between treatment groups by more than a half pretreatment SD.

Nocturia

Overall, the 261 men experienced a significant increase in nocturia scores by the end of treatment: an individual patient mean increase was 1.08 (95% CI, 0.8 – 1.3) and median increase was 1.0 (-8.5 to 8). However, no significant difference by tracking method was observed.

Alpha-blocker Use

At baseline, 24% of Calypso and 34% of Gold patients in the standard IMRT group used an alpha-receptor antagonist ($p = 0.2$). By the end of treatment, the respective prevalence values increased to 46% and 66%, and the difference by tumor tracking method became significant ($p = 0.01$).

Among subjects with a pretreatment IPSS < 15 who didn't use an alpha-blocker before RT, 39% of Calypso patients and 63% of Gold patients needed to start one at some point during the RT ($p = 0.04$). However, no significant difference in medication use was found during the follow-up.

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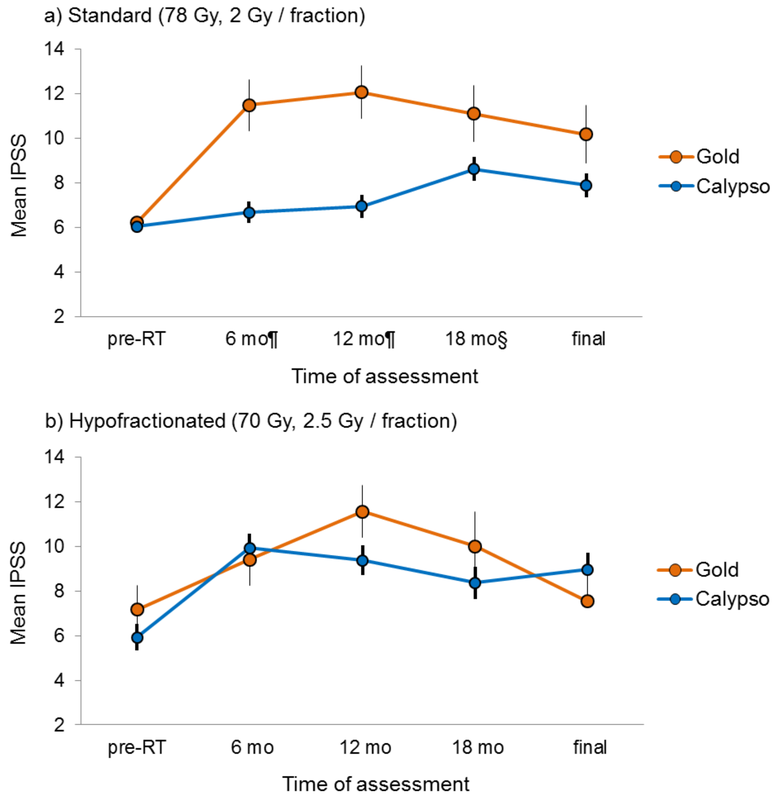
IPSS Trends by Tumor Tracking Modality



Analysis with mixed linear models showed a significant difference in posttreatment trends of mean IPSS between Calypso and Gold cohorts in standard IMRT group ($p = 0.006$) but not in the hypofractionated one.

Patients with pre-RT IPSS < 15:

The maximal difference between the means reached 5.1 points ($p = 0.004$), at 12 months. This difference was 1.5 pre-RT SD, corresponding to a large clinical effect size.

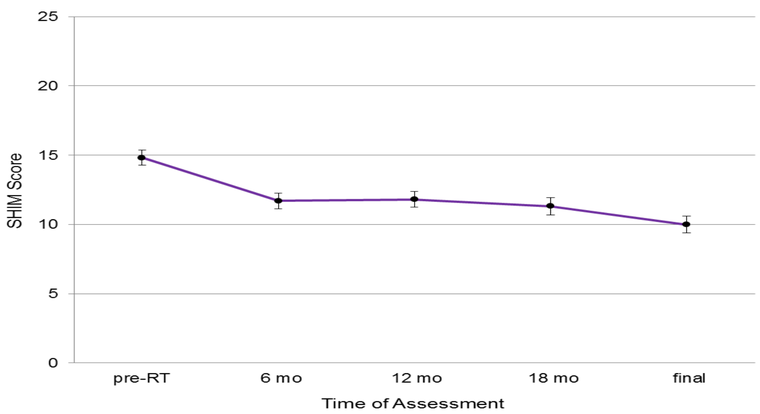
The maximum individual patient median rises, seen around 18 months, were 2.8 (-9 to 15) and 5.5 (-5 to 14) points in Calypso and Gold cohorts respectively and differed significantly ($\chi 2 = 4.1$, $p = 0.04$).

Patients with pre-RT IPSS ≥ 15:

The maximum individual patient median drop was -7.5 (-30 to 11) and -8 (-25 to 2) points in Calypso and Gold cohorts respectively; however, this difference was not significant.

Figure 2a & 2b. Changes in the mean IPSS over time by tumor tracking modality in patients without poor baseline urinary function (pre-RT IPSS < 15) treated with standard (a) and hypofractionated (b) regimens. Paragraph symbols (¶) designate time points at which mean scores differed significantly ($p < 0.01$ to account for Bonferroni adjustment) between treatment groups by more than 1.0 pretreatment SD; section mark (§) designates such difference of 0.7 pretreatment SD at $p = 0.08$.

SHIM Score Trends



At pretreatment baseline, the median SHIM score was 16 (0 to 25) points.

At 6 months, it decreased to 13 (0 to 25). The individual patient score dropped by a mean of -3.1 (95% CI, -4.8 to -1.5; $p < 0.001$) and median of -1 (-24 to 15) points.

At the final follow-up, the median SHIM score decreased to 8 (0 to 25) points. The individual patient score dropped by a mean of -5.1 (95% CI, -7.4 to -2.9; $p < 0.001$) and median of -3.5 (-22 to 9) points.

There was no significant difference in SHIM score trends by tracking modality, regardless of IMRT regimen.

Figure 3. SHIM score trends in 93 patients not treated with ADT.

Conclusion

Real-time tracking was associated with a reduced need for α-blockers during the RT and reduced post-treatment increase in urinary symptoms in men with pre-RT IPSS < 15. This difference was not only significant but had a large clinical effect size; however, it was present only with standard but not with hypofractionated IMRT regimen. Further studies are needed to investigate effects of dose regimen on clinical benefits of real-time tracking.