



A randomized trial of supine vs. prone positioning in patients undergoing escalated dose conformal radiotherapy for prostate cancer

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Background

Controversy regarding tumor targeting, patient position, and immobilization for external beam radiotherapy to the prostate has existed for more than two decades. Central to this debate has been the argument whether treating the patient in the prone versus the supine position better spares normal tissues while providing adequate target coverage. Patient immobilization, daily target localization, and the physiologic impacts of bowel and bladder are known to directly mitigate the effects of position. This article from the Princess Margaret Hospital sought to delineate the effects of patient position on organ motion, positioning errors, and dose to critical structures through a randomized crossover study in prostate patients with organ-confined disease.

Methods

- 28 patients with organ confined prostate patients were initially randomized to treatment simulation in either the prone or supine position. The intent of the study was for all patients to cross over midway through treatment to simulation and treatment in the other position until treatment was completed.
- Endpoints of the study included isocenter positioning errors (IPE); prostate motion (PM); total positioning error (TPE); dose-volume histograms of bladder, rectum, and small bowel; and patient and radiotherapist satisfaction with set-up and treatment.
- After patients were positioned daily according to their tattoos, differences in isocenter position were assessed by alternate day lateral port films compared to simulation radiographs. The IPE reflected changes in isocenter position with respect to bony landmarks.
- PM was assessed by measuring changes in position of three gold fiducial markers placed in the prostate prior to initial simulation.
- TPE was calculated as the sum of IPE and PM.
- Patients were either treated with six or seven coplanar fields. A single radiation oncologist delineated all target and critical structures. PTV margins on the CTV were 1.0 cm in all directions except posteriorly where they were 0.7 cm.
- Patient and therapist satisfaction with treatment were assessed by a weekly questionnaire.
- Data from 20 patients was available for calculation of motion and set-up error.
- After all patients had been treated, a modified PTV for the prone position was created based on the perception that there was more PM in the prone position. DVH's obtained with the modified prone PTV were compared to the original DVH's of the supine PTV.

Results and Conclusions

- There was no significant difference seen in the IPE or TPE. However, more pre-treatment corrections were made for the prone position.
- Prostate motion in the supine position had a mean of 0.1 mm +/- 3.6 mm in the anterior/posterior dimension with a range of 10.6 mm to 9.3 mm.

- Prostate motion in the prone position had a mean of 0.7 mm +/- 4.0 mm in the anterior/posterior dimension with a range of 8.8 mm to 7.6 mm.
- When comparing the fields actually treated, only the D 50% isodose line was significant and favored supine treatment.
- When comparing the modified prone PTV to the supine PTV, differences in the D95%, D80%, and D50% isodose lines are all significant favoring supine treatment.
- Therapist and patients both preferred the supine position for ease of set-up and comfort.

Discussion

This study reports on a randomized trial comparing organ motion, positioning errors, and dose to critical structures in patients with prostate cancer treated in the supine and prone positions with external beam radiotherapy. The authors conclude that there is no difference in TPE or DVH isodose to bowel, bladder and rectum for isodose D85% and greater. Furthermore, supine treatment is favored by both patient and radiotherapist.

Bentel and colleagues have shown that the physiological status of the bladder and rectum greatly impacts prostate shape and location in the pelvis in a dynamic fashion (*Int. J. Radiation Oncology Biol. Phys.*, Vol. 47, No. 1, pp. 247–253, 2000). Many groups employ considerable effort to localize the prostate daily

using either fiducial markers or BAT ultrasound. Through daily target localization, the differences between prone and supine treatment appear to be largely mitigated. In these settings, the debate between supine versus prone positioning is reduced to one of comfort and simplicity.

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