

AbstractID: 2675 Title: Design and construction of a realistic pelvic phantom for a level III dosimetry study

Purpose: Verification of dose delivery is a basic necessity of quality assurance in radiotherapy treatment, and is extremely valuable in determining uniformity of protocol adherence in the context of a multi-centre trial. To verify the delivery of radiotherapy doses and dose distributions it is necessary to replicate the entire treatment process as accurately as possible in a way that allows the direct measurement of doses. A pelvic phantom was constructed to investigate the 3D delivery of radiotherapy (Level III dosimetry) for rectal and prostate cancer treatment in collaboration with the Trans-Tasman Radiation Oncology Group.

Method and Materials: A CT dataset of a male pelvis was used to define the geometric boundaries of principle tissues – bone, prostate, seminal vesicles, bladder, rectum and muscle. Points of interest were located throughout the dataset to identify appropriate placement of TLD materials. The centre of the prostate was identified as the location for point-measurement with a small-volume ionization chamber. Polyurethane materials for phantom construction were evaluated in terms of their durability, ability to be milled and radiographic qualities.

Results: The pelvic phantom has been manufactured and has undergone commissioning. CT numbers for different density materials match well with typical tissues. TLD measurements in the phantom show a reproducibility of 2 %. The proposal for the inter-centre study has led to a high (> 85 %) accrual of radiotherapy centres in Australasia. The phantom has now been used at a large number of participating centres.

Conclusion: This study will provide estimates of variation in critical structure outlining, expansion algorithms and dose volume histograms across different planning systems. In addition local irradiation techniques, geometric and dosimetric accuracy dose distributions in realistic materials, and the feasibility of multi-centre dosimetry studies is assessed.