ABSTRACT

The Greedy Heuristic (GH) algorithm based on ROI adjoint functions is employed to generate the seed and needle configuration for treatment plan utilizing the mixed seeds and for treatment plan utilizing the pure isotropic seeds.

METHODS AND MATERIALS

The sensitivity fields of the urethra and rectum were generated for a partially shielded 1-231 directionally implanted brachytherapy source. The dose data for the directional source is taken from the 1-231 directional source developed at UW-Madison by Dr. Lin et al. Directional source along with isotropic source can be used to provide partial shielding in brachytherapy optimization via forward and adjoint transport. Using this greedy heuristic algorithm, treatment plans are generated for interventional prostate implant brachytherapy. The treatment plans are mixed source treatment plans utilizing isotropic and directional sources for implants. The algorithm directs directional sources strategically at positions near the sensitive structures for better shielding, and optimizes their distribution in the bulk of the prostate volume for dose compensation. Whenever, directional sources contribute sparing the sensitive structures from reaching the interstitially implanted directional sources.

RESULTS AND DISCUSSION

Mixed-seeds plans are compared with the isotropic seeds plan. All treatment plans are generated using automated 3D-GH-algorithm.

CONCLUSIONS

• Used automated 3D greedy heuristic algorithm based on adjoint sensitivity fields along with directional sources for interstitial prostate implant brachytherapy
• Achieved dose uniformity
• Very efficient rectum sparing
• Improved urethra sparing
• Mixed seeds brachytherapy can be used for LDR BRT of the prostate.

INTRODUCTION

Adjoint particle transport in sensitivity profile generation for seed positions

Directional seed and Greedy Hearty Optimization

We present the results of a newly developed automated 3D greedy heuristic optimization algorithm utilizing the adjoint sensitivity fields of the directional source and the isotropic source seed. Directional interstitial brachytherapy is based on a partially shielded 1-231 I-125 interstitially implanted brachytherapy source. The dose data for the directional source is taken from the 1-231 directional source developed at UW-Madison by Dr. Lin et al. Directional source along with isotropic source can be used to provide partial shielding in brachytherapy optimization via forward and adjoint transport. Using this greedy heuristic algorithm, treatment plans are generated for interventional prostate implant brachytherapy. The treatment plans are mixed source treatment plans utilizing isotropic and directional sources for implants. The algorithm directs directional sources strategically at positions near the sensitive structures for better shielding, and optimizes their distribution in the bulk of the prostate volume for dose compensation. Whenever, directional sources contribute sparing the sensitive structures from reaching the interstitially implanted directional sources.

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FURTHER WORK

Toward reduction of hot spots

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