

2010

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Recommended Citation

Podder, T. K.; Dicker, A. P.; and Yu, Y. (2010) "Comparison of a Novel Curvilinear Approach to Conventional Rectilinear Approach for Prostate Seed Implant," *Bodine Journal*: Vol. 3 : Iss. 1 , Article 16.

DOI: <https://doi.org/10.29046/TBJ.003.1.015>

Available at: <https://jdc.jefferson.edu/bodinejournal/vol3/iss1/16>

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Comparison of a Novel Curvilinear Approach to Conventional Rectilinear Approach for Prostate Seed Implant

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Purpose

To evaluate dosimetric benefit of curvilinear distribution of seeds for low-dose-rate (LDR) prostate brachytherapy with I-125 isotopes.

Method and Materials

In this study, ten LDR prostate brachytherapy cases used clinically were randomly selected as reference rectilinear cases. These cases were planned intra-operatively with VariSeed version 7.1 using I-125 seeds (STM-1251 model). All the cases were replanned by using curved-needles keeping the same individual seed's activity and volume receiving 100% of prescribed dose 145Gy (V100). Various parameters such as number of total needle, number of total seeds (or total activity), and dose coverage of prostate (D90, V150, V200), urethra (D30, D10) and rectum (D5, V100 in cc) were compared.

Results

Average reductions in required number of needles and seeds (or activity) were 30.1% and 10.6%, respectively for curvilinear approach. In case of prostate, average D90 reduced by 7.9% (203.9Gy in rectilinear, 187.5Gy in curvilinear); average V150 and V200 coverage reduced by 17.9% (66.4% in curvilinear) and 32.6% (29.4% in curvilinear), respectively. For urethra, average D30 reduced by 10% (from 205.3Gy in rectilinear to 184.7Gy in curvilinear) and D10 reduced by 9.4% (from 210.8Gy in rectilinear to 190.0Gy in curvilinear). In case of rectum, average reduction in V100 was 71.6% (from 0.91cc in rectilinear to 0.21cc in curvilinear) and reduction in D5 was 17.7% (from 160.4Gy in rectilinear to 131.2Gy in curvilinear).

Conclusion

We observed considerable reduction in all studied parameters for curvilinear approach. Prostate dose homogeneity (V150, V200) improved while urethral dose is reduced, which will potentially result in better treatment. Large reduction in rectal dose would potentially reduce rectal toxicity and complications. Reduction in number of needles would minimize edema and thereby would improve accuracy of seed delivery and total dose distribution. This study indicates that the curvilinear approach is dosimetrically superior to conventional rectilinear technique.