

Dosimetric Comparison of Conventional Optimization Methods with Inverse Planning Simulated Annealing Technique

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Abstract : Various optimization methods used in interstitial brachytherapy are based on dwell positions and dwell weights alteration to produce dose distribution based on the implant geometry. Since these optimization schemes are not anatomy based, they could lead to deviations from the desired plan. This study was henceforth carried out to compare anatomy-based Inverse Planning Simulated Annealing (IPSA) optimization technique with graphical and geometrical optimization methods in interstitial high dose rate brachytherapy planning of cervical carcinoma. Six patients with 12 CT data sets of MUPIT implants in HDR brachytherapy of cervical cancer were prospectively studied. HR-CTV and organs at risk (OARs) were contoured in Oncentra treatment planning system (TPS) using GYN GEC-ESTRO guidelines on cervical carcinoma. Three sets of plans were generated for each fraction using IPSA, graphical optimization (GrOPT) and geometrical optimization (GOPT) methods. All patients were treated to a dose of 20 Gy in 2 fractions. The main objective was to cover at least 95% of HR-CTV with 100% of the prescribed dose ($V_{100} \geq 95\%$ of HR-CTV). IPSA, GrOPT, and GOPT based plans were compared in terms of target coverage, OAR doses, homogeneity index (HI) and conformity index (COIN) using dose-volume histogram (DVH). Target volume coverage (mean V_{100}) was found to be $93.98 \pm 0.87\%$, $91.34 \pm 1.02\%$ and $85.05 \pm 2.84\%$ for IPSA, GrOPT and GOPT plans respectively. Mean D_{90} (minimum dose received by 90% of HR-CTV) values for IPSA, GrOPT and GOPT plans were 10.19 ± 1.07 Gy, 10.17 ± 0.12 Gy and 7.99 ± 1.0 Gy respectively, while D_{100} (minimum dose received by 100% volume of HR-CTV) for IPSA, GrOPT and GOPT plans was 6.55 ± 0.85 Gy, 6.55 ± 0.65 Gy, 4.73 ± 0.14 Gy respectively. IPSA plans resulted in lower doses to the bladder (D_2)

Keywords : cervical cancer, HDR brachytherapy, IPSA, MUPIT

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