Conclusions: The presented analytical dose calculation algorithm is applicable for any type of heterogeneity. The high calculation speed of the algorithm makes it feasible for use in clinical real-time treatment planning and thus for improving treatment quality.

PO-0967

Loose seeds vs. stranded seeds in permanent prostate brachytherapy: dosimetric comparison of intraoperative plans

T. Major1, P. Agoston1, K. Bariczai1, G. Fröhlich1, C. Polgar1
1National Institute of Oncology, Radiotherapy, Budapest, Hungary

Purpose/Objective: To evaluate and compare the dosimetric parameters of intraoperative treatment plans in prostate seed implants performed with loose seed and stranded seed techniques.

Materials and Methods: Permanent prostate brachytherapy with I-125 seeds as a monotherapy for patients with low and intermediate risk prostate cancer was implemented at our institute in 2009, and since then 147 patients have been treated. The first 79 patients were implanted with loose seeds (seedSelect, Nucletron) and the next 68 patients with stranded seeds (IsoSeed, Bebig). Loose seeds (LS) were delivered automatically with the seedSelectron system, while stranded seeds (SS) were placed into the prostate manually. For treatment planning the SPOT PRO 3.1 (Nucletron) software was used for all patients. The number and positions of seeds were calculated with an inverse dose optimization algorithm (IPS) in the pre-implant plan. Then, the seeds were implanted under transrectal ultrasound guidance, and their real positions were updated in live planning. The prescribed dose was 145 Gy. Dose-volume histograms were calculated and volumetric parameters were used to evaluate the plans. V100 (%), DHI, D90 (Gy) and COIN were determined for the prostate, while D max and volumetric parameters were used to evaluate the plans. V100 (%), D0.1cm3 (Gy), D2cm3 (Gy), D10 (%) for the urethra, and D max (%) D0.1cm3 (Gy), D2cm3 (Gy), D10 (%) for the rectum. Means and standard deviations were calculated and compared for both intervention groups.

Results: On average, 54 and 47 seeds were implanted in the prostate with individual median seed activities of 0.49 and 0.56 mCi for LS and SS technique, respectively. The median needle number was 15 and 17, correspondingly. The mean prostate volumes were practically identical (33.4 vs. 33.9 cm3). The dose coverage was similar (V100: 96% vs. 97%, D90: 167 Gy vs. 169 Gy) in the two groups, and the dose homogeneity was identical (DHI: 0.39). The conformity of dose distributions was better for LS (COIN: 0.70 vs. 0.65). Regarding the dose to urethra all dosimetric parameters were significantly lower (p<0.05) for LS (Dmax: 138% vs. 154%, D0.1cm3: 126 vs. 140 %, D10: 125 vs. 136 % and D30: 119 vs. 128 %). The rectum received less dose with the SS technique (Dmax: 101% vs. 112 %, D2cm3: 82 Gy vs. 97 Gy, D0.1cm3:127 vs. 143 Gy, and D10: 75% vs. 86%) (p<0.05 for all).

Conclusions: In permanent prostate seed brachytherapy the dose to urethra and rectum is less with SS technique compared to LS technique in the intraoperative plans. Moreover, the conformity of dose distributions is also better with LS along with the same homogeneity of dose distributions. Probably the more flexible loading pattern for LS technique results in the more favourable dose distributions.

PO-0968

Available guidance, current UK practice, and future directions for HDR brachytherapy quality control

A. Nisbet1, A.L. Palmer2, D.A. Bradley1
1Royal Surrey County Hospital & Surrey University, Medical Physics, Guildford, United Kingdom
2Portsmouth Hospital NHS Trust & Surrey University, Medical Physics(F Level) Queen Alexandra Hospital, Portsmouth, United Kingdom

Purpose/Objective: A survey of high dose rate (HDR) brachytherapy quality control (QC) procedures undertaken at radiotherapy centres in the United Kingdom (UK) is reported [1]. Published recommendations and guidance for HDR QC are also reviewed and compared to current UK practice. Recent changes in clinical brachytherapy techniques and the impact on required QC is discussed. Modern methods to determine optimum quality checking processes are indicated. This work is conducted in the context of the recent ‘point/counterpoint’ debate in Medical Physics that ‘QA procedures in radiation therapy are outdated and negatively impact the reduction of errors’ [2] and a review of the dosimetric accuracy in HDR [3].

Materials and Methods: All UK radiotherapy centres were asked to participate in a survey of their approach and practice for HDR brachytherapy QC. This included guidance used, frequencies and tolerance values for individual QC tests. A comprehensive evaluation of responses was conducted detailing popularity of tests, and the average and range values of testing and tolerance. A literature search was conducted on general guidance, specific QC techniques in both brachytherapy and teletherapy, and on risk-based systems for quality assurance.

Results: Survey data was acquired from 31 UK radiotherapy centres and statistical analysis of responses performed. 45 possible individual QC tests were identified. There was general agreement on measurement frequency and tolerance for key QC tests, e.g. measurement of source position in a straight catheter, checked daily and with a 0.1mm tolerance in most centres. There was disagreement on a number of tests, e.g. the need for regular x-ray imaging of applicators. There was absence of tests that may be deemed necessary for modern brachytherapy practice, e.g. confirmation of planned and delivered dose distributions. There is likely a need to move from a device-centred to a system-centred approach, using risk-based assessment methods to determine required QC testing, with emphasis on clinical processes rather than simple device operation. Table 1 provides sample key results from the work.

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Conclusions: The only contemporary benchmark survey of HDR QC practice has been undertaken. The outcome of this work is a review of current practice against available recommendations, relevant recent changes in clinical brachytherapy techniques, and the use of modern quality process assessments. Recommendations for appropriate, optimised QC for HDR brachytherapy are made.

PO-0969

Air kerma rate measurements for Ir-192 and Co-60 HDR sources using three different international protocols.

F.W. Hensley1, H.A. Azhari2, W. Schütte3, G.A. Zakaria1
1Univ. Klinikum Heidelberg, Department of Medical Physics, 69120 Heidelberg, Germany
2Gono Bishwabidyalay University, Department of Medical Physics and Biomedical Engineering, Dhaka 1344, Bangladesh
3Gummersbach Hospital, Department of Radiation Therapy, 51643 Gummersbach, Germany

Purpose/Objective: To evaluate and compare the dosimetric parameters of intraoperative treatment plans in prostate seed implants performed with loose seed and stranded seed techniques.