SU-I-GPD-T-23

Fabrication and Dosimetric Evaluation of In-House HDR Brachytherapy Multichannel Applicator and Multichannel QA Phantom

Senthilkumar Shanmugam[1,*], (1) Madurai Medical College & Govt. Rajaji Hospital, Madurai, Tamilnadu, INDIA

Purpose: The main purpose of this study was to fabricate and dosimetric evaluation of in-house inexpensive HDR brachytherapy multichannel applicator and multichannel QA phantom for vaginal brachytherapy. **Methods:** Both the HDR multichannel vaginal applicator and multichannel QA phantom was fabricated using perspex. To prevent displacement of the applicator, I have made a extra supporting curved plate to tie the applicator with patient. The QA phantom consists of 20 cm × 20 cm box and the same dimension of the multichannel applicator fixed in the one side of the phantom. Applicator can be fixed in the center of the phantom and filled with water. The phantom has the provision to insert the 2 numbers of 20 cm × 20 cm plates, which has many holes to insert the Gafchromic films, TLD and OSLD dosimeters. **Results:** The multichannel applicator and QA phantom design improves the dosimetry over single channel applicators and shows that a uniform dose around the applicator as compared to single channel. In addition a more uniform dose distribution can be attained. The multichannel applicator allows much better dose control than the central channel applicator. The multichannel applicator achieves lower bladder and rectal doses by 15% and 17%, respectively, when compared to the central channel applicator. **Conclusion:** The multichannel applicator enables more flexibility in isodose shaping and dose control to various points and structures when compared to the conventional central channel applicator. It is consistent with one of the QA aims that is achieving a desired level of accuracy and precision in the dose delivery. Our findings showed that this QA phantom after minor corrections can be used as a method of choice for intercomparison analysis of TPS and to fill the existing gap for accurate QA program in intracavitary brachytherapy.

SU-I-GPD-T-24

New Gold-198 Nanoparticle Synthesis to Be Used in Cancer Treatment

C Daruich de Souza*, M Chuery Martins Rostelato, C Zeituni, A Del Carmen Castro Gonzalez, B Ribeiro Nogueira, IPEN, Sao Paulo, Sao Paulo

Purpose: Nanoparticle (NPs) is the name given to particles that are in the nanoscale (nm). Their configuration in the nanometric size promotes alteration in their physical, chemical, and biological behaviors. Gold nanoparticles have been studied for over 100 yr. Recently, gold-198 NPs are being studied for application in treat prostate cancer. The idea is to insert the radioactive NPs solution directly inside the cancer with a syringe. Although the synthesis of gold nanoparticles is extensively reported, in the majority of cases the methodology is confuse and/or not clear. Besides that, the toxicity of the reactants and stability during reactor activation must be taken into account when developing products for medical applications. We describe a new synthesis methodology for radioactive gold-198 NPs. **Methods:** 0.1 mM HAuCl4 containing 100 μL of 1 M NaOH was prepared in a flask equipped with a reflux condenser. The solution was brought to boil and stirred with a PTFE-coated magnetic stir-bar. Then 5 mL of Na3Ctr was rapidly added. The reaction turn from light yellow to clear, black, dark purple until the solution attained a wine-red color (2–3 min). The reaction was allowed to proceed for 7 more minutes (completing 10 in total). 1 mL of the nanoparticle solution was separated to undergo activation in IPEN's IEA-01 reactor for activation. **Results:** Dynamic light scattering (DLS) confirmed 8 nm particles. The presence of gold-198 (197.968 g/mol; half-life: 2.69517; decay mode: β-; average energy: 1.3723 MeV) was confirmed by an ORTEC HPGE detector. DLS was performed after complete decay confirming the 8 nm diameter maintenance. **Conclusion:** We were able to achieve radioactive gold-198 NPs and are performing further studies such as: coating reactions, in-vitro and in-vivo studies. (Supporting document show a TEM image of the nanoparticles and the reaction color change described in methods.)

SU-I-GPD-T-25

Optic Disc and Macula Dose Estimation Without Dose Calculations in Ocular Brachytherapy Using 125I Standard COMS Plaques

S Lin*, Y Lee, Y Kim, The University of Arizona, Tucson, AZ

Purpose: The purpose of this study is to generate comprehensive domestic data for optic disc and macula doses in ocular brachytherapy using 125I Collaborative Ocular Melanoma Study (COMS) plaques to allow clinicians in our institution to estimate optic disc and macula doses without dose calculations in a treatment planning system (TPS). **Methods:** An in-house brachytherapy dose calculation program utilizing the American Association of Physicists in Medicine Task Group-43U1 formalism with a line source approximation was developed and validated against benchmark calculations in the literature. Then optic disc and macula doses were calculated as a function of distance from tumor margin (DT and MT) for various basal dimensions (BD and BM) for six (12 mm–22 mm in diameter in 2 mm increments) COMS plaques loaded with 125I (model IAI-125A) seeds. A prescribed dose of 85 Gy was normalized at a central-axis depth of 5 mm. Calculations were repeated for different prescription depths (1 mm–10 mm in 1 mm intervals). Dose conversion factors to estimate optic disc and macula doses for different prescription depths were obtained by taking ratios of air kerma strength at the different prescription depths to that at 5 mm. **Results:** The in-house program demonstrated similar accuracy to commercial TPS and Monte Carlo codes. Optic disc dose decreased as DT and BD increased. Similar patterns were observed for macular dose. Plaque size determined optic disc and macular doses and the shape of dose curves. Dose conversion factors decreased with increasing prescription depth. Also, the factors increased with increasing plaque size for a prescription depth <5 mm but the opposite was observed for a depth >5 mm. **Conclusion:** The clinical data generated in this study will be beneficial in our clinical practice to predict optic disc and macula doses without dose calculations in a TPS.

SU-I-GPD-T-26

Optic Disc Dose Reduction in Ocular Brachytherapy Using 125I Notched COMS Plaques

Y Lee[1,*], S Lin[1], Y Xu[1], Y Kim[1], (1) University of Arizona, Tucson, AZ

Purpose: The purpose of this study is to investigate optic disc dose reduction in ocular brachytherapy using notched Collaborative Ocular Melanoma Study (COMS) plaques loaded with 125I seeds to allow clinicians to estimate optic disc dose reduction before treatment planning. **Methods:** Using a validated in-house brachytherapy dose calculation program utilizing the American Association of Physicists in Medicine Task Group-43U1 formalism with a line source approximation, optic disc dose was calculated as a function of optic disc-to-tumor margin distance (DT) for various basal dimensions (BD) for six (12 mm–22 mm in diameter in 2 mm increments) standard and notched (with one seed removed) COMS plaques loaded with 125I (model IAI-125A) seeds. A prescribed dose of 85 Gy was normalized at a central-axis depth of 5 mm. Then optic disc dose reduction was computed by subtracting optic disc dose for notched plaques from that for standard plaques. **Results:** First, does reduction increases with DT, reaches the maximum and then decreases with DT. For the largest 2-3 BDs for each plaque, however, dose reduction decreases with DT. Second, the maximum dose reduction (105.1 Gy, 67.4 Gy, 70.1 Gy, 45.8 Gy, 41.8 Gy, 49.0 Gy for 12 mm, 14 mm, 16 mm, 18 mm, 20 mm and 22 mm plaques, respectively) does not vary with BD except for that for the largest 2–3 BDs. Third, DT at which the maximum dose reduction occurs (DTmax) decreases by almost 1 mm with increasing BD by 2 mm. For the largest 2–3 BDs, on the other hand, the maximum dose reduction usually occurs at 0 mm of DT or close to 0 mm. Lastly, DTmax increases with plaque size for the same BD. **Conclusion:** The data provided in this study will be beneficial in clinical practice to estimate optic disc dose reduction by notched COMS plaques before treatment planning.

SU-I-GPD-T-27

Comparison of Optic Disc Dose Reduction Between 125I and 103Pd Notched COMS Plaques in Ocular Brachytherapy

Y Lee[1,*], S Lin[1], Y Kim[1], (1) University of Arizona, Tucson, AZ

Purpose: The purpose of this study is to compare optic disc dose reduction between 125I and 103Pd notched Collaborative Ocular Melanoma Study (COMS) plaques. **Methods:** Optic disc dose was calculated as a function of optic disc-to-tumor margin distance (DT) for various basal dimensions (BD) for five (14 mm–22 mm in diameter in 2 mm increments) standard COMS plaques loaded with 125I (model IAI-125A) and 103Pd (model IAPd-103A) seeds in a validated in-house brachytherapy dose calculation program utilizing the AAPM TG-43U1 formalism with a line source approximation. A dose of 85 Gy was prescribed at a central-axis depth of 5 mm. Calculations were repeated for five corresponding notched COMS plaques with one seed removed (case 1) and two seeds removed (case 2). Then for each case, optic