SUNDAY, JULY 26

Student Meeting
Room 210 A

SU-AA-210A

No abstract provided.

Professional Symposium
Ballroom D
Professional Council Symposium

SU-AA-BRD-01
Update On AAPM State Licensing Efforts
M Bevan[1] *, J Limmer[2] , (1) Bevan , Watchung, New Jersey, (2) Aspirus Regional Cancer Center, Wausau, WI

The AAPM and ACMP are sponsoring state licensing efforts in 5 states: Pennsylvania, Missouri, Massachusetts, Michigan, and Ohio. This part of the session will provide an update from the lobbying firm with whom we have contracted.

SU-AA-BRD-02
Licensure and the Practicing Medical Physicist:AAPM Licensure Regulations Guidance Document
R Pizzutiello[1] *, (1) Upstate Medical Physics, Victor, NY

AAPM has made a significant commitment of priorities and resources to advance licensure in the 46 states that do not presently license medical physicists. Pending federal legislation may motivate States to implement licensure on a short timetable.

The AAPM Licensure Regulations Guidance Document is among the significant steps in this effort completed by the Joint Medical Physics Licensure Sub-Committee (JMPLSC). This document was created modeled after the licensure laws in Texas, New York and Florida.

This session will review the big picture of how licensure is accomplished, and how licensure will affect the practicing medical physicist. Key provisions of the Guidance document will be presented with an emphasis on practical implementation issues.

SU-AA-BRD-03
A New "CARE" and a New Focus
L Fairobent[1] *, (1) AAPM, College Park, MD

As you are aware we have a new administration and a new congress and health care reform is a priority of both. On July 15, 2008 the Medicare Improvements for Patients and Providers Act of 2008 (MIPPA) was enacted making changes to the Medicare program. There has been a lot of confusion over MIPPA and how it relates to the goals we have for the "CARE" legislation (which stands for Consistency, Accuracy, Responsibility, and Excellence in Medical Imaging and Radiation Therapy (CARE) Act of 2009"). Questions have been raised do we still need to pursue the CARE legislation. This session will review the relationship between MIPPA, proposed CARE legislation and the overall AAPM and ACMP efforts to efforts to ensure that medical physics is performed by Qualified Medical Physicists.

Learning Objectives**:**
1. To review the provisions of the Medicare Improvements for Patients and Providers Act of 2008 (MIPPA).
2. To discuss the between MIPPA and the proposed "Consistency, Accuracy, Responsibility, and Excellence in Medical Imaging and Radiation Therapy (CARE) Act of 2009."
3. To review the overall AAPM and ACMP efforts to ensure that medical physics is performed by Qualified Medical Physicists.

Education Council Symposium
Ballroom B

SU-BB-BRB-01
Content and expectations of the Medical Physics Residency Self - Study Workshop
J Bayouth*

No abstract provided.

Therapy Moderated Poster Session
Exhibit Hall - Area 1
Moderated Poster - IMRT I

SU-DD-A1-01
Improving Delivery Accuracy of Volumetric Modulated Arc Therapy (VMAT)
J Ye , M Rao , F Chen , D Cao , Swedish Cancer Institute, Seattle, WA

Purpose: To evaluate the effect of VMAT sequencer, MLC leaf motion range and MU difference for adjacent control points in VMAT plan, and gantry interval used for dose calculation on the treatment delivery accuracy. **Material and Methods**: VMAT plans with leaves moving across the field in alternate open-close pattern for every 10 degrees of rotation were created on Pinnacle SmartArc 8.1v and Ergo++ V1.7.1, where VMAT DICOM RT plans were generated with different sequencers. Various MLC motion range and MU with different ratios were assigned to the adjacent control points. The plans were delivered on Elekta Synergy. Measurements with Matrixx ion-chamber array were analyzed. Gamma passing rate were evaluated using dose calculated by interpreting the MU and MLC shapes between control points with different gantry intervals. **Results**: DICOM plans transferred from SmartArc had higher gamma passing rate than those from Ergo++. Passing rate decreased as the MU ratio increased for Ergo++ because its VMAT sequencer averaged the MU from two adjacent control points. Less than 2% difference was observed between dose calculated with 1 and 2 degree gantry interval. Compared to plans with 2.5cm MLC motion, passing rate for 5.0cm plans decreased by 5-15%. Verification results degraded as MU ratio increased from 5:5 to 1:9 if dose was calculated using the gantry interval of 2 degrees or larger. Gamma pass rate decreased as the calculation interval increased from 2 to 10 degrees for VMAT plans were calculated assuming MLC leaves were stationary between control points. **Conclusion**: Smaller MLC leaf motion range can improve VMAT delivery accuracy. A sequencer capable of keeping original MU for each control point should be used to generate VMAT DICOM RT plan. Fine gantry interval should be used for dose calculation to show the VMAT plan that reflects the delivered dose accurately.

Research supported by Elekta

SU-DD-A1-02
Incorporating Prior Knowledge Into the Segment Optimization in Segment-Modulated Arc Therapy
Y Ma[1] *, L Xing[2] , (1) Stanford University School of Medicine, Stanford, CA, (2) Stanford Univ School of Medicine, Stanford, CA

Purpose: Recently, various stochastic algorithms have been applied to the segment modulated arc therapy (SMART) inverse planning. Most, if not all, algorithms are brute force trial-and-error search in nature without inclusion of *a priori* knowledge for segment position and shape. The purpose of this work is to provide an effective way to speed up the SMART planning process by incorporating dosimetric knowledge of the system into the segment shaping. **Methods**: The SMART inverse planning was performed in two steps. First, the maximum intensity map (MIM) was evaluated for each beam. The intensity of MIM is defined as the maximum intensity without violating the threshold dose of the organ-at-risks (OARs) located on the path of the beamlet. Based on MIM, a probabilistic map (MP) model was properly established which describes the probability for a beamlet to be open (=1) or close (=0). A rule of thumb is that a beamlet traversing sensitive OARs (which is *bad*) tends to

Materials: Mammosite brachytherapy is delivered using a balloon catheter placed inside a lumpectomy cavity in a breast. The balloon is filled with a contrast solution to fit inside the lumpectomy cavity. In our institution the treatment is planned using CT images of the breast on an Eclipse treatment planning computer. We have found that the density of the contrast solution can vary significantly depending on the solution inserted in the balloon by the surgeons. CT numbers as high as 3000 Hounsfield Unit (HU) have been found in the mammosite balloon at our institution. The Eclipse treatment planning system does not take into account the heterogeneity of the contrast solution in treatment time calculation. We investigated the effect of the contrast solution on dose using film dosimetry and Varian Varisource 200 HDR unit with an Ir-192 source. The solution form the balloon of a patient with CT number of 3000 HU was used in our study. A plan was created to deliver a dose which fell within the linear range of Kodak X-Omat V film. The same geometry and irradiation time was used to irradiate films which under the contrast solution and water respectively. The films were read with a densitometer and the ratio of the optical density gave the dose ratio for the solution relative to water. **Results:** Solutions with CT numbers of 3000HU and 2000HU showed a reduction in dose of 10% and 5% respectively compared to water. **Conclusion:** Our study indicates that there can be a dose reduction in mammosite treatments where the CT number of the solution is high compared to water. The appropriate corrections should be made to deliver the intended dose in mammosite treatments with Ir-192 source.

SU-FF-T-72

Dosimetric Comparison of SAVI, MammoSite, Contura and Clearpath for Accelerated Partial Breast Irradiation

D Scanderbeg[1] *, P Barna[1] , S Jiang[1] , T Pawlicki[1] , C Yashar[1] , (1) University of California, La Jolla, CA

Purpose: The number of intracavitary hdr brachytherapy devices available to treat women with early stage breast cancer has increased significantly in the past several years. Blending the dosimetry of interstitial and the ease of use of MammoSite; SAVI, Contura, and Clearpath have made their way into the arena. One would postulate that the evolution of the devices in the sense of dose modulation, from least to greatest, would be MammoSite, Contura, Clearpath, and finally SAVI. This stems from the location of peripheral struts in relation to the cavity boundary. In this study, we compare the dosimetry between the 4 devices and assess their efficacy through dose volume histograms (DVH) and maximum point doses of critical structures. Comparing these modalities will help determine either the best overall treatment device or the best device for a particular type of patient. **Materials and Methods**: Nine patients treated with SAVI at UC San Diego were selected for this comparison. CT scans were retrospectively evaluated for delivery of APBI via MammoSite, Contura and Clearpath by simulating them in place of the SAVI in the lumpectomy cavity. The anterior tissue surrounding the balloon devices was linearly expanded to simulate tissue displacement by the balloon. All plans were generated using Brachyvision TPS (Varian Medical Systems, Palo Alto, CA). **Results**: DVHs of the target volume were evaluated against planning criteria taken from the NSABP B-39 protocol. All devices met the criteria and had similar target coverage (V90 ~ 98%). However, there were differences in the dose received by normal tissue with skin dose lowest in SAVI patients (~71% of prescribed dose). This was followed by Contura, MammoSite and Clearpath, respectively. **Conclusions**: All devices had similar coverage of the target volume, but SAVI had the most dose flexibility for patients with close skin spacing and chestwall proximity.

SU-FF-T-73

Evaluation of Inverse Planning Dose Optimization for HDR Brachytherapy in Treatment of Cervical Cancer

L Tao[1] *, B Taylor[2] , (1) , Longview, TX, (2) Texas Oncology-Longview Cancer Center, Longview, TX

Purpose: We investigated the differences between geometrical optimization and inverse planning simulated annealing (IPSA) for the treatment of cervical cancer. **Methods and Materials:** Patients were selected and two optimization plans for each patient were generated with geometrical optimization and IPSA. The clinic target volume and critical organs were contoured using Oncentra MasterPlan Version 3.1(Nucletron Corp., Veenendaal, The Netherlands). For each patient, the dose constrains and optimization parameters were set to meet clinic goal for all plans. The dose volume histograms (DVH) of target and critical organs were generated for comparison. **Results:** We found that IPSA significantly improved the target dose homogeneity compared with geometrical optimization. For the tumors adjacent to critical structures, IPSA dramatically spared the volume of the critical structures to be irradiated. **Conclusions:** IPSA is superior over geometrical optimization in terms of target coverage and minimizing normal structures irradiated.

SU-FF-T-74

Preplanning of Suture Coordinates for Episcleral Plaque Therapy

M Astrahan[1] *, (1) Univ Southern California, Los Angeles, CA

Purpose: Episcleral plaques are attached to the eye by sutures which affix eyelets to the sclera. Historically, plaque position was determined by transilluminating the eye to cast a shadow of the tumor onto the sclera, outlining this shadow, and subsequently deciding where to suture the eyelets. 3D modeling enables scleral coordinates for each eyelet to be determined prior to surgery. **Methods:** The retinal diagram is a polar map of the retinal surface in which the posterior pole is located at the center of the map surrounded by radial spokes representing meridians and concentric rings of lattitude which terminate at the limbus which is the border of the cornea and sclera. Eyelet coordinates on an equivalent scleral diagram can be expressed using a meridian, a chord distance from the limbus along that meridian, and the chord distance between the eyelets. It is common to express diagram meridians as clock hours so coordinates for a plaque with two eyelets might be something like: eyelet #1 along the 12:40 o'clock meridian, 9.1 mm from the limbus, eyelet #2 along the 2:10 meridian 9.4 mm from the limbus, and 9.2 mm between the eyelets. **Results:** Over 300 patients have been treated at USC using calculated suture coordinates. Only in a handful of cases involving anterior tumors for which fundus photography was impossible was it necessary to empirically adjust coordinates. Admittedly subjective observation suggests that plaque placement to within about 8 degrees circumferentially and 0.5 mm radially of the planned position is routinely achievable. Examples will be presented. **Conclusion:** When the tumor location can be accurately determined from fundus photography, the placement of a plaque and its suture eyelets can be accurately preplanned. **Conflict of Interest:** Software which implements this technology is licensed by BEBIG GmbH for distribution under the name Plaque Simulator.

SU-FF-T-75

Importance of Contamination Signal Removal On HDR Brachytherapy In Vivo Dosimetry When Using a Scintillating Fiber Dosimeter.

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Purpose: To quantify the importance of removing the contamination signal, composed of Cerenkov and fluorescence light, from the output of an in vivo scintillating fiber dosimeter during Iridium-192 HDR brachytherapy treatments. **Method and Materials:** The scintillating fiber dosimetry system is composed of a miniature monochrome CCD camera (Apogee Alta U-4000) detecting light from optical fibers. Two fibers were used for the purpose of this study: one of those had a 3 mm x 1 mm cylindrical scintillator (BCF-60) coupled to its extremity. Integrating light coming out from both fibers under the same irradiation conditions allows, following proper calibration, to determine the scintillation and the contamination components of the detector signal. This study has been conducted in a solid water phantom. Components of the detector signal have been studied as a function of angular, longitudinal and radial position of the Ir-192 source with respect to the detecting volume (i.e. scintillator). **Results:** The contamination component ranged from 4% to 42% of the detector signal, depending on the relative source to scintillator and fiber positions. The highest ratio was obtained when the source was the closest to the scintillator. The lowest was obtained when the source is longitudinally the furthest from the source. The ratio increased from 4% to 10% with the source going from 1cm to 5cm on the radial axis of the scintillator. Angular study reveals that both contamination and scintillation components of the signal varies under 3.4 percents over the complete angles range. **Conclusion:** Dose determination is proportional to the amount of scintillating light measured. Based on our measurements, the necessity of removing the contamination component of the signal is obvious to obtain an accurate dose calculation. Any

decontamination procedures. All participants received a toolkit with valuable training tools.

WE-D-211A-08

Options to Revise NRC Radiation Protection Regulations

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In December 2007, the International Commission on Radiological Protection (ICRP) published revised and updated recommendations for radiation protection as ICRP Publication 103. The Nuclear Regulatory Commission (NRC) staff engaged in a comparative review of the NRC Standards for Protection Against Ionizing Radiation, 10 CFR Part 20, and other NRC regulations, with ICRP Publication 103, and provided the Commission with recommendations for next steps in December, 2008. The Commission has approved the staff recommendation to seek early engagement with stakeholders and interested parties on the technical and regulatory issues and options for potential changes to the agency's radiation protection regulations, to achieve greater alignment between the regulations and ICRP Publication 103. The NRC staff is particularly interested in understanding the perspectives of different organizations and groups on the benefits, burdens, and impacts of possible options for change. The NRC staff has not made any decisions on particular positions or changes at this time. This presentation provides background on the current regulatory framework, the contents of the 2007 ICRP recommendations, the status of international standards updates, and describes issues identified by NRC staff as initial key topics for discussion with stakeholders on options and necessary technical information for possible future rulemaking. These issues include the occupational dose limits, the application of constraints to the optimization process, and updates of the scientific information and models supporting dose assessment and compliance.

WE-D-211A-09

Occupational Health Hazards in the Interventional Laboratory

S Balter[1], L Fairobent[2], D Miller[3], (1) Columbia University Medical Center, New York, NY, (2) AAPM, College Park, MD, (3) National Naval Medical Center, Bethesda, MD

Efforts to better define the occupational risks associated with working in a fluoroscopic laboratory led to the formation of the Multi-Specialty Occupational Health Group (MSOHG). The main goal of this group is to clarify the magnitude and impact of the occupational health concerns of the cardiologists, radiologists, and surgeons working with fluoroscopy; pain management specialists performing nonvascular fluoroscopic procedures; and the many support personnel working in interventional laboratory work environment. This paper will briefly review the physical stresses inherent in this career choice appear to be associated with a predisposition to orthopedic injuries, attributable in great part to the cumulative adverse effects of bearing the weight and design of personal protective apparel worn to reduce radiation risk, and to the poor ergonomic design of interventional suites.

Therapy Symposium
Ballroom D
Imaging and Treatment Planning for Adaptive Radiotherapy in the Head and Neck

WE-D-BRD-01

Imaging and Treatment Planning for Adaptive Radiotherapy in the Head and Neck

J Sonke[1] *, K Brock[2] *, L Dong[3] *, V Gregoire[4] *, (1) Netherlands Cancer Institute, Amsterdam, NL, (2) Princess Margaret Hospital, Toronto, ON, CA, (3) UT MD Anderson Cancer Center, Houston, TX, (4) Cliniques Universitaires St-Luc, Brussels, BE

The integration of in-room volumetric imaging into the treatment delivery process has provided the ability to identify soft tissue changes in the head and neck over the course of radiotherapy. These changes include tumor response and changes in the position and volume of normal tissues. When these changes are substantial, registration of the daily online image to the planning image becomes challenging, if not impossible, and may result in a large change in the intended dose to the tumor and a violation of the dose constraints for the surrounding normal tissue. Research has begun to examine the implications associated with addressing these issues through adaptive radiotherapy, and commercial treatment planning systems are beginning to include the structure necessary for handling these changes. This symposium will describe techniques for performing adaptive radiotherapy including imaging for adaptive radiotherapy, deformable registration and dose accumulation, replanning and re-optimization which includes the delivered dose, optimizing re-planning timing, and clinical significance. To address these important issues surrounding imaging and treatment planning for adaptive radiotherapy in response to soft tissue changes, this symposium will be divided into the following four topics. Imaging and immobilization for adaptive radiotherapy in the head and neck will be examined, including identifying the need for replanning, the level of image quality necessary to accomplish this task, as well as immobilization and positioning strategies. Deformable registration and dose accumulation in the head and neck will be discussed, evaluating quality assurance, accuracy, and validation techniques and methods to handle volume reduction. Including the delivered dose, improving efficiency, and optimizing the number and timing of replanning events will be evaluated in the context of replanning and re-optimization for head and neck. The clinical significance of performing adaptive replanning will be highlighted, including a presentation on the results of studies performed and a look to the future as to what studies should be performed.

Learning Objectives:

1. Understand when re-planning is necessary and the level of image quality required for re-planning.
2. Understand the accuracy achievable and validation methods for deformable registration techniques used to relate in-room volumetric imaging to the planning dataset.
3. Discuss dose accumulation, including methods for handling volume reduction and QA.
4. Review and evaluate current state-of-the-art capabilities for re-planning with regards to incorporating delivered dose, efficient workflow, as well as visualization and quantification of results.
5. Explore methods for optimizing the frequency and timing of re-planning events.
6. Understand the clinical significance of adaptive planning with regards to reported results to date and potential future results

Therapy Scientific Session
Ballroom B
Brachytherapy

WE-D-BRB-01

Eye Plaque Dosimetry: Report of the AAPM Therapy Physics Committee Task Group No. 129

F Mourtada[1] *, S Chiu-Tsao[2] , M Astrahan[3] , P Finger[4] , D Followill[1] , A Meigooni[5] , C Melhus[6] , M Napolitano[7] , R Thomson[8] , M Rivard[6] , M Parish[9] , D Rogers[8] , R Nath[10] , (1) UT MD Anderson Cancer Center, Houston, TX, (2) Quality MediPhys LLC, Denville, NJ, (3) Univ Southern California, Los Angeles, CA, (4) The New York Eye Cancer Center, New York, NY, (5) North Shore Univ Hosp-Long Island Jewish Health, Manhasset, NY, (6) Tufts Medical Center, Boston, MA, (7) Elekta Inc., Norcross, GA, (8) Carleton University, Ottawa, ON, CA, (9) Univ. of Kentucky, Lexington, KY, (10) Yale Univ School of Medicine, New Haven, CT

Purpose: The AAPM Eye Plaque Dosimetry Task Group 129 presents an update of the dosimetry calculations for the Collaborative Ocular Melanoma Study (COMS) plaques. Results from a multi-center comparison using several brachytherapy treatment planning systems (BTPSs) are presented. **Method and Materials**: Dose distributions around 16-mm diameter COMS plaques loaded with I-125 (model 6711) or Pd-103 (model 200) were determined using three TG43-based BTPSs (Pinnacle v8.0d, BrachyVision v6.1 and v8.1, PlaqueSimulator v5.3.7), and two Monte Carlo codes (MCNP5 and BrachyDose). TG-43 plans assumed an unbounded homogeneous medium. Monte Carlo plaque simulations included the Modulay (gold alloy) backing, Silastic (silicone polymer) insert, and interseed interactions. Doses along tumor central axis (-1 to 20 mm) and to defined critical structures such as fovea, optic disc, lens center, and lacrimal gland center in a standard eye model were

calculated. **Results**: Agreement among all TG-43 based plans on the central axis was within ±2% for both point- and line-source approximations. However, for off-axis points, BrachyVision v 6.1 had a truncation error in coordinates, which resulted in dose deviation of about 5% relative to other plans. As expected, the doses at off-axis points were lower for the line source approximation than the point source approximation. The largest deviations were found at the lacrimal gland center, where the line source model resulted in 10% and 20% less dose than the point source model for I-125 and Pd-103 sources, respectively. Monte Carlo simulations predicted dose values are about 20-30% lower than the average of TG-43 plan values, due to full plaque geometry; with the exception of few off-axis points up to 90% lower. **Conclusions**: This multi-center comparative analysis of BTPSs dose results indicated the importance of careful selection of TG-43 parameters, source model assumptions, and the BTPS coordinate resolution limits, and the value of complete Monte Carlo calculations.

WE-D-BRB-02

Comparing a Grid-Based Boltzmann Solver with Monte Carlo Simulation for Voxel-Based Therapeutic Radionuclide Dose Calculations

J Mikell[1] *, O Vassiliev[1] , W Erwin[1] , T Wareing[2] , F Mourtada[1] , (1) UT MD Anderson Cancer Center, Houston, TX, (2) Transpire Inc, Gig Harbor, WA

Purpose: To compare the accuracy and speed of a deterministic grid-based Boltzmann solver (GBBS) with Monte Carlo (MC) simulations for calculating voxel-based absorbed dose rates from SPECT/CT imaging. **Methods:** A SPECT/CT image of a breast cancer patient with metastatic osteosarcoma was obtained using a tracer administration of ^{153}Sm EDTMP. The therapeutic activity administered was determined from MIRD estimates. DOSXYZnrc and the GBBS Acuros were used to calculate dose rate maps from the activity distribution over the full CT grid. The GBBS photon dose rate was calculated using the collisional KERMA approximation rather than explicitly transporting the generated electrons; an energy cutoff was used to neglect spatial transport of electrons below a threshold of 200 keV for Acuros and 189 keV for DOSXYZnrc. The photon, beta-particle, and total absorbed dose rates calculated using GBBS were compared with the gold standard MC simulations using the gamma index. Gamma index parameters evaluated were 3%/3mm and 5%/5mm; both used a step size of 0.5mm with a 10 mm search distance. A patient mask was created from the CT to report pixels within/near the patient. The gamma failure points (γ>1.0) within the patient mask were viewed overlaid on the activity map and on the CT for the calculated beta, photon, and total dose rates. **Results:** For total dose rate, 90.1% and 99.6% of pixels within the patient mask had $\gamma \leq 1.0$ for 3%/3mm and 5%/5mm respectively. γ failures were noticed at the edges of the activity distribution for beta-particles, and at various interfaces for the photons. For Acuros, the beta-particle and photon transport required about 10 minutes each. DOSXYZnrc took approximately 15,000 times longer. **Conclusions:** GBBS has the potential to provide accuracy similar to MC in a much shorter time; this could be useful for voxel-based radionuclide absorbed dose estimates in a clinical setting.

WE-D-BRB-03

Novel Plaques for Iris Melanoma I-125 and Pd-103 Brachytherapy

R Thomson[1] *, K Furutani[2] , D Rogers[1] , (1) Carleton University, Ottawa, ON, CA, (2) Mayo Clinic, Rochester, MN

Purpose: To calculate three dimensional dose distributions in the eye region for novel plaques used in the treatment of iris melanoma at the Mayo Clinic and compare these with dose distributions for other plaques used in these treatments. **Method and Materials:** The EGSnrc user-code BrachyDose is used to perform Monte Carlo simulations. Plaques and seeds are fully modeled. The Mayo Clinic plaques are based on the Collaborative Ocular Melanoma Study (COMS) 22 mm plaque design with a gold alloy backing, outer collimating lip, and silicone polymer insert. An inner collimating lip surrounds a 10 mm diameter cutout region at the plaque center. Plaques span 180, 270, and 360 degree arcs. Three-dimensional dose distributions in the eye region are calculated and are compared via depth-dose curves, tabulation of the dose at critical structures (cornea, sclera, lens, macula, optic disk), and isodose contours. **Results:** The inner lip reduces dose to the cornea and surrounding region by 30-45%. Doses at some points of interest (e.g. cornea) differ by as much as 60-70% compared to those calculated with the TG-43 protocol. The outer lip collimates radiation and significantly reduces doses to neighboring tissues. Catering plaque arc length to tumor extent reduces doses to the anterior portion of the eye outside the treatment area. For the same prescription dose, Pd-103 offers a lower dose to critical structures than I-125, with the exception of the sclera adjacent to the plaque. **Conclusion:** The Mayo Clinic plaques offer a number of advantages compared to other plaques used in the treatment of anterior eye tumors. Dose is significantly reduced to regions outside the treatment area. Calculations achieving 2% statistical uncertainty on the prescription dose take a few minutes on a single CPU, making BrachyDose sufficiently fast for routine clinical treatment planning.

WE-D-BRB-04

An Evaluation Study of Treatment Planning of Brain Tumor Using Implanted Neutron Brachytherapy and Compared with Photon IMRT

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Purpose: The objective of this study is to perform a plan evaluation using Californium-252 neutron brachytherapy for the treatment of malignant gliomas and compare the neutron brachytherapy planning with photon IMRT planning. **Materials/Methods**: After a phase I trial of neutron brachytherapy (Cf-252 implant) for the treatment of malignant gliomas, there is renewed interest to evaluate the effectiveness of radiation therapy using neutron brachytherapy compared with photon IMRT. Here we performed a dosimetric comparison of two treatment plans based on the same patient using equivalent prescribed dose. Isodose lines and dose volume histogram of brain tumor and adjacent critical structures were used for plan evaluation. Dose of neutron brachytherapy was calculated using CT-converted Monte Carlo model and simulated by Monte Carlo code MCNPX. The tissue component of Monte Carlo model was adapted from the sectioned images of human cadavers of the Visible Human Project of NLM. Dose of IMRT plan was calculated using Pinnacle3 TPS. A relative biological effectiveness of 6 was used to determine the neutron equivalent dose (ncGy) for central nervous system (CNS) tissues. An equivalent dose of 6000 cGy was prescribed for both the IMRT plan and the neutron brachytherapy plan. **Results**: The targets were well covered by the 95% isodose line in both IMRT and neutron brachytherapy plans. Comparing the IMRT and Cf-252 neutron brachytherapy, the mean dose was 6102 cGy and 6708 ncGy for target, 403 cGy and 177 ncGy for brainstem, 1022 cGy and 311 cGy for chiasm, 311 cGy and 275 ncGy for pituitary, and 705 cGy and 420 ncGy for brain, respectively. **Conclusions**: Cf-252 Brachytherapy provided conformal dose distribution to the brain tumor and reduced the dose to the surrounding critical organs compared to IMRT. The implanted Cf-252 source provides high dose to brain tumor and reduces the radiation exposure of normal brain.

WE-D-BRB-05

Novel Post-Lumpectomy Breast Cancer Brachytherapy with the Capability of Simultaneous Focal Lymph Node Irradiation

B Hrycushko[1] *, S Li[2] , C Shi[3] , Y Liu[4] , A Bao[5] , (1) University of Texas Health Science Center, San Antonio, TX, (2) University of Texas Health Science Center, San Antonio, TX, (3) Cancer Therapy & Research Center, San Antonio, TX, (4) Cancer Therapy & Research Center, San Antonio, TX, (5) Univ Texas Health Sci Ctr, San Antonio, TX

Purpose: A new technique of post-lumpectomy breast cancer brachytherapy using beta-emitting therapeutic radionuclides, rhenium-188 (Re-188) and rhenium-186 (Re-186), carried within lipid nanoparticles (liposomes) was investigated. This therapy strategy is advantageous regarding: 1) mm-range focal radiation by beta-particles ensures localized brachytherapy; 2) sustained high local retention within the lumpectomy cavity and accumulation in associated lymph nodes enables simultaneous cavity and lymph node focal radiation therapy; and 3) ease and flexibility of this modality to treat various locations and cavity shapes in the breast with minimal invasiveness. **Method and Materials:** Breast cancer surgical model in nude rats, gamma camera imaging, and animal organ dissection were used to study local and lymph node retention of radioactive liposomes. EGSnrc Monte Carlo code