Ohio River Valley Chapter

Spring Educational Symposium Agenda

Saturday, March 7th, 2009	
7:30 am to 8:00 am	Vendor Setup
8:00 am to 8:50 am	Check-In Continental Breakfast
8:50 am to 9:00 am	**Welcome and Introduction** Matthew A. Meineke, Ph.D. President, Ohio River Valley Chapter Hardin Memorial Hospital
9:00 am to 10:15 am	**Keynote Address: Challenges and Opportunities in Medical Imaging** William R. Hendee, Ph.D. Medical College of Wisconsin
10:15 am to 10:30 am	**An optimized Protocol for using Small Field MV Cone-Beam CT Imaging in Image-Guided Radiotherapy (IGRT)** Guy Yembi-Goma, MS Ohio State University
10:30 am to 10:45 am	**Outcome Prediction of Cervical Cancer: Kinetic Model of Tumor Regression during Radiation Therapy** Zhibin Huang, Ph.D Ohio State University
10:45 am to 11:00 am	**A Dosimetric Analysis of IMRT Used to Replace and Mimic HDR Brachytherapy in the Treatment of Gynecologic Malignancy** Jared Weatherford University Of Cincinnati
11:00 am to 11:15 am	**Coffee Break**
11:15 am to 11:30 am	**Monte Carlo simulation of electronic disequilibrium in small lung nodules** Eric Lobb University of Kentucky
11:30 am to 11:45 am	**Near Source Dosimetry of HDR Base of Tongue Treatments Using TPS & GafChromic HD-810 Film** Marcus Luckstead University of Cincinnati
11:45 am to 12:00 pm	**To Reduce Hot Dose Spots in Cranial-Spinal Irradiation: A Two-Field IMRT Approach with Matching Beam Divergence** Alburuj R. Rahman Ohio State University
12:00 pm to 1:00 pm	**Lunch Break** Boxed lunches provided
1:00 pm to 1:15 pm	**Impact of Fraction Dose in Hypo-Fractionated Megavoltage Grid Therapy for Melanoma** Jessica Traeger Ohio State University
1:15 pm to 1:30 pm	**Study of Enhanced Absorption of X-rays by Nanoparticles in Cancer Treatment** Maximiliano Montenegro, Ph.D. Ohio State University

2mm away. Brachytherapy treatment planning computers assume a homogeneous medium. This assumption means that backscatter dose enhancement from high atomic number heterogeneities is unaccounted for.

Methods: A HDR treatment plan was developed to deliver a uniform planer dose at a depth of 1cm from a simple planer geometry applicator. This plan was used for both the calibration of the GrafChromic HD-810 film and the experimental measurements. Scaling of the prescription dose was used to deliver doses of 10, 20, 50, 75, and 150Gy for a calibration curve. Measurements of the plans dose will be done at depths of 10mm, 7mm, 5mm, 2mm, 1mm, and at the surface. Two different prescription doses will be used for these measurements; 10Gy at 1cm for the distant measurements (10mm, 7mm, and 5mm) and 1Gy at 1cm for the close measurements (2mm, 1mm, and surface). These measurements will be performed in solid water with and without a bone equivalent backscatterer. For analysis the doses will be scaled. Measured doses will be compared to the treatment planning system using 25 point doses in the central region of the radiation field.

Discussion: Accurate dosimetric predictions are necessary at all distances and under all conditions for treatment planning purposes so that physicians can properly assess tumor control probability and normal tissue complications. A treatment planning systems ability to deal with both the inverse square law at short distances and heterogeneities can have a significant impact on a physician's ability to control a tumor and spare normal tissue.

To Reduce Hot Dose Spots in Cranial-Spinal Irradiation: A Two-Field IMRT Approach with Matching Beam Divergence

Alburuj R. Rahman
Ohio State University

Purpose: In craniospinal irradiation (CSI), two beams are commonly used to cover the spinal cord because of the required long field length. In general, hot or cold spots of dose coverage occur in the field junction region due to the inherent challenges posed by different beam divergences. The purpose of this study is to develop new techniques to reduce or eliminate the hot/cold spots and achieve more uniform dose coverage in the spinal cord.

Materials and Methods: Two approaches to reduce the effect of beam divergence were investigated. Tilted PA beams were used in both methods with the table rotated 90° and prone patient position. In the first method, we employed four beams arranged in two pairs to replace the original two-beam approach. Each of the paired beams was tilted towards each other along the direction of the spinal cord, with a gantry angle of 5-8 degrees. The paired beam reduced the divergence as compared to single beam. Physical or dynamic wedges were used to improve the dose uniformity in the cord region. In the second method, a two-beam IMRT technique was employed. The second beam was tilted in the direction of the spinal cord to accomplish an exact beam-divergence match with the first beam. The collimator was rotated to the 90° position with MLCs moving perpendicular to the spinal cord to compensate the dose inhomogeneity due to different SSDs.

A phantom torso was scanned in CT and imported to Eclipse for this study. Plans were created for each method and compared with the conventional CSI technique, with respect to spinal cord dose.

Results: Our preliminary data indicate that both new techniques can improve the dose homogeneity of spinal cord over the conventional technique. When normalizing the mean dose to 180 cGy, the minimum dose is approximately 168cGy for all three plans; however, the maximal doses are quite different: 237cGy, 204cGy and 201cGy for the conventional, 4-field and IMRT plans respectively. The uniformity index measured by the standard deviation of the dose distribution is 7.5cGy, 8.3cGy, and 6.5 cGy for the three plans respectively.

Conclusion: Two new methods with matching beam divergence have been developed for CSI. They have the advantage to effectively reduce hot spots and improve the dose uniformity in the spinal cord. The 4-field technique can be used in IMRT-incapable facilities. The two-field IMRT technique has the greatest potential and is feasible to be implemented clinically. This marked improvement in dose coverage of the beam-divergence matching methods warrants further studies with patient planning data.

Impact of Fraction Dose in Hypo-Fractionated Megavoltage Grid Therapy for Melanoma

Jessica Traeger
Ohio State University

Purpose: To evaluate the impact of fraction dose in hypo-fractionated megavoltage grid therapy for melanomas of different sizes.

Material and methods: A Monte Carlo technique was employed to calculate the 3D dose distribution of a commercially available megavoltage grid collimator in a 6MV beam. The linear-quadratic (LQ) model was used to evaluate the therapeutic outcome of a series of the hypo-fractionated (fewer fractions and higher dose/fraction) regimens using grid therapy to treat diverse melanomas with different radio-biological responses. The dose prescription point was at the center of tumor, which was also located at the central axis of the central hole of the grid collimator. The fraction doses from 2 to 30 Gy were used. The spherical tumors used in this study ranged from 2 to 6 cm in diameter. The tumors were located either at the surface of the skin or with their centers at a depth of 3 cm.

Results: The tumor cell and normal tissue survival statistics of grid therapy using single large fraction doses were calculated using 3-D dose distributions. Equivalent uniform doses (EUD) and therapeutic ratios (TR) were derived for diverse tumor sizes and depths. The EUDs of all tumor sizes were found to be only a fraction of the nominal dose; the TRs were found to be dependent on both the tumor size and fraction dose.