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<th>Time</th>
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<tr>
<td>11:00 am to 12:00 pm</td>
<td>Vendor Setup</td>
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<tr>
<td>12:00 pm to 12:50 pm</td>
<td><strong>Check-In / On-Site Registration</strong></td>
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<tr>
<td>12:50 pm to 1:00 pm</td>
<td><strong>Welcome and Opening Remarks</strong></td>
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<tr>
<td></td>
<td>Valdir Colussi, Ph.D., President, Penn-Ohio Chapter, UH Case/Seidman Cancer Center, Cleveland</td>
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<td>Keli Wilson, M.S., Past President, Penn-Ohio Chapter, UPMC, Pittsburgh</td>
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<tr>
<td>1:15 pm to 3:45 pm</td>
<td><strong>Continuous Afternoon Snack Break Service</strong></td>
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<tr>
<td>1:00 pm to 1:12 pm</td>
<td>State Space of Ventilatory Flow of SBRT Lung Cancer Patients</td>
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<td>Darek Michalski. UPMC</td>
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<tr>
<td>1:12 pm to 1:24 pm</td>
<td>Potential Utility of High Resolution DTI in Radiation Therapy of Prostate Cancer</td>
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<td>M Hwang. UPMC</td>
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<tr>
<td>1:24 pm to 1:36 pm</td>
<td>Image-Guided Percutaneous Intervention with a Smart Flexible Needle: Design, Development and Control</td>
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<td>M. Orlando. CASE</td>
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<td>1:36 pm to 1:48 pm</td>
<td>Is Dosimetry of Multiple Met Radiosurgery Vendor Platform Dependent?</td>
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<td>Y. Zhang. UPMC</td>
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<td>1:48 pm to 1:50 pm</td>
<td>Q&amp;A</td>
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<td>1:50 pm to 2:02 pm</td>
<td>Transmission Factor as a Function of Patient Thickness in Portable Chest X-ray</td>
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<td>Chris L. Liptak. CSU-CCF</td>
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<tr>
<td>2:02 pm to 2:14 pm</td>
<td>The Impact of Input Parameter Accuracy on Monte Carlo Simulated Organ Dose in Chest CT</td>
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<td>John S. Muryn. CSU</td>
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<td>2:14 pm to 2:26 pm</td>
<td>Monte Carlo Comparison of Absorbed Dose Delivered to Non-Targeted Tissues during Stereotactic Radiosurgery, Brachytherapy, and Proton Radiation Therapy for Age-Related Macular Degeneration</td>
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<td>Justin Cantley. CASE</td>
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<td>2:26 pm to 2:38 pm</td>
<td>Comprehensive Evaluation of Three Deformation Image Registration Algorithms Using Digital Phantoms Created from Patients with Head and Neck Cancer</td>
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<td>Zhilei Liu Shen. CCF</td>
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<tr>
<td>2:38 pm to 2:40 pm</td>
<td>Q&amp;A</td>
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<tr>
<td>2:40 pm to 3:20 pm</td>
<td><strong>Vendor Exhibits / Snack Break</strong></td>
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<tr>
<td>3:20 pm to 4:10 pm</td>
<td><strong>Practical Guidance for Commissioning and Clinical Implementation of Deformable Image Registration (pre-TG132)</strong></td>
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<td>Kristy K. Brock, Ph.D., Associate Professor, University of Michigan, Ann Arbor, MI</td>
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<tr>
<td>4:10 pm to 4:40 pm</td>
<td><strong>Wading Through the Task Group Matrix at a Community Hospital - The MetroHealth Experience</strong></td>
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<td>Ravi Kulaskevere, PhD - Director of Clinical Physics. MetroHealth Medical Center, Cleveland</td>
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<tr>
<td>4:40 pm to 4:50 pm</td>
<td>Travel Grant Report &amp; Educational Awards</td>
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<tr>
<td>4:50 pm to 5:00 pm</td>
<td>1. John Muryn (CSU)</td>
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<td>5:00 pm to 5:10 pm</td>
<td>2. Yongqian Zhang (UPMC)</td>
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<tr>
<td>5:10 pm to 5:30 pm</td>
<td>3. Zhilei (Julie) Shen (CCF)</td>
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<tr>
<td>5:30 pm to 6:00 pm</td>
<td><strong>Award Ceremony</strong></td>
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<tr>
<td>6:00 pm to 7:00 pm</td>
<td><strong>Poster Viewing Session at Jimmy Wans (Cash bar)</strong></td>
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<tr>
<td>7:00 pm to 10:00 pm</td>
<td><strong>Dinner at Jimmy Wans with Digest Talks:</strong></td>
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<td>How AAPM Task Groups (TGs) are Born – M. Saiful Huq Ph.D. (UPMC / AAPM Board Member-At-Large)</td>
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<td>Safety is Not a Task: the RO-ILS Initiative in the Matrix - Barry W. Wessels, Ph.D. (UH-CWRU / PA-OH Chapter Representative)</td>
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# AAPM Penn-Ohio Chapter FALL SYMPOSIUM AGENDA

**Saturday, October 18th, 2014**

<table>
<thead>
<tr>
<th>Time</th>
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<tr>
<td>7:30 am to 10:45 am</td>
<td>Continuous Continental Breakfast / Vendor Setup</td>
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<tr>
<td>7:15 am to 7:30 am</td>
<td>Check-In / On-Site Registration / Vendor Setup</td>
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</table>
| 7:50 am to 8:00 am  | Opening Remarks  
Valdir Colussi, Ph.D., President, Penn-Ohio Chapter, UH Case / Seidman Cancer Center, Cleveland  
Michael Ohm, M.S., Secretary, Penn-Ohio Chapter, Cleveland Clinic, Cleveland. |
| 8:00 am to 8:50 am  | Keynote Lecturer  
Minimum Practice Standards in Clinical Medical Physics  
Per H. Halvorsen, MSc, FAAPM, Chair of the AAPM Professional Council, Lahey Clinic, Burlington, MA |
| 8:50 am to 9:40 am  | Rationale for Modern Radiation Oncology, Hypofractionation and SBRT  
Colin G. Orton, Ph.D, Professor Emeritus, Wayne State University, Detroit, MI |
| 9:40 am to 10:20 am | Vendor Exhibits / Coffee Break                                             |
| 10:20 am to 11:10 am | Small Field Dosimetry  
M. Saiful Huq, Ph.D., Professor, Director of Medical Physics Division, University of Pittsburgh Cancer Institute |
| 11:10 am to 12:00 pm | Radiation Response of Brain Tumors and Normal Tissue after Stereotactic Radiosurgery  
David A. Clump II, MD, PhD, Radiation Oncologist specializing in H&N malignancies and stereotactic radiosurgery, UPMC |
| 12:00 pm to 12:30 pm | Executive-Style Lunch / Vendor Talks / Vendor Exhibits  
12:30 pm – 12:50 pm: Standard Imaging  
12:50 pm – 1:10 pm: Sun Nuclear |
| 1:30 pm to 2:00 pm  | Education of State Regulators  
Charles A. Wissuchek (Chuck), M.S., Western Reserve Medical Physics LLC |
| 2:00 pm to 2:50 pm  | Radiation Therapy: State of the Art and the Future  
M. Saiful Huq, Ph.D. Professor, Director of Medical Physics Division, University of Pittsburgh Cancer Institute |
| 2:50 pm to 3:30 pm  | Concluding Remarks  
Valdir Colussi, Ph.D., President, Penn-Ohio Chapter, University Hospitals Case Seidman Cancer Center, Cleveland  
Keli Wilson, M.S., Past President, Penn-Ohio Chapter, UPMC, Pittsburgh  
Michael Ohm, M.S., Secretary, Penn-Ohio Chapter, Cleveland Clinic, Cleveland |
| 3:00 pm to 3:30 pm  | Penn-Ohio Business Meeting / Vendor Tear Down                             |
**Research Presentations:**

### State Space of Ventilatory Flow of SBRT Lung Cancer Patients

**Darek Michalski - University of Pittsburgh Medical Center, Pittsburgh, PA.**

**Purpose/Objectives:**
The real nature of respiration is complex and exhibits nonlinear features. The breathing dynamics is analyzed applying the state space reconstruction.

**Materials/Methods:**
The data consists of 20 breathing tracks recorded with RPM system during the 4DCT scan of SBRT lung cancer patients. The method of delays unfolds the state space (SS). The delay time (Td) is obtained from the average mutual information. The method of False Nearest Neighbors determines the dimension (D). Nonlinear stationarity is determined with one-ahead prediction. Determinism is gauged with factor D of local flow method. Non-linearity tests are based on rank-order tests of original BTs and their surrogates. The statistics for these tests were: the multilevel Lempel-Ziv complexity (LZC) with alphabets with $2^l$ ($l=1,...,10$) symbols, Sample Entropy (SEnt), Time Reversibility (Tr(t)), Theiler's Statistic (Tstat) and Prediction Error. The chaos of the system is evaluated with the Largest Lyapunov Exponent (LLE).

**Results/Conclusions:**
The $<\text{Td}>=1.25s$, the SS dimensions were $D=4$ and $D=5$. The Td was 30% of the average breathing period. The stationarity factor was 0.14 (0 is perfect, 1 for no-better than the constant prediction). Determinism was 0.98 (0 for stochastic system, 1 for deterministic). Surrogate data tests showed the nonlinear feature. The $<\text{LLE}>=0.27 s^{-1}$. All LLE $>0$ which shows the sensitive dependence on initial conditions. The LL showed Pearson correlation with the average breathing period with $r=0.74$. The LLE dictates the time horizon of the system, which was 60% of the average breathing period. The variety of breathing patterns might not be explained with application of conventional sinusoidal-like breathing models. The SS approach may aid in designing prediction algorithms for compensation of tumor motion. If breathing signal shows these characteristics it would also suggest tumor motion may exhibit the same characteristics. Thus considering the dynamic system theoretic could lead to more realistic tumor motion management.

### Potential Utility of High Resolution DTI in Radiation Therapy of Prostate Cancer

M Hwang¹, S Blackband², J Forder², L Su², B Vemuri², S Jang¹, S Huq¹
(¹) University of Pittsburgh Medical Center, Pittsburgh, PA. (²) University of Florida, Gainesville, FL

**Purpose:**
Radiation therapy has remained a mainstay in non-surgical treatments for clinically localized prostate cancer. However, the radiation induced damage to the nerve fibers surrounding the prostate gland is associated with the risk of post-radiation erectile dysfunction. It is due to a lack of knowledge of the precise anatomic course of the nerves that are responsible for penile erections. This study aims to investigate the utility of diffusion tensor magnetic resonance imaging (DTI) using microscopic resolution in radiation therapy of prostate cancer.

**Materials and Methods:**
Human prostates (n=6) that contain the cavernous nerves were dissected from fixed male adult cadavers. High resolution DTI was performed on the excised whole prostates at 11.1 T magnet and small samples cut from one whole prostate were scanned at 17.6 T magnet to obtain MR image that could provide direct histological validation.

**Results:**
DTI parameters can be correlated with the cavernous nerve fibers immediately surrounding the prostate. By using small pieces of excised prostate tissue containing the cavernous nerves, MRI achieving 70 micron of in-plane spatial resolution could represent a direct correspondence of MRI and histology for the cavernous nerves. The primary eigenvector map could infer orientation of the nerve fibers. The fiber tracts support the correlation between the MR fibers and nerve bundles found in histology.

**Conclusion:**
These data demonstrate the feasibility of generating high resolution fiber tract maps of the excised and fixed human prostate. This implies that the DTI has the potential to assist brachytherapy or external beam approaches to prostate cancer treatment by developing anatomic maps of the cavernous nerve fibers, providing a potentially important tool or “road map” for guiding nerve sparing during prostate radiation, ultimately promising significant reductions in erectile dysfunction.
Image-Guided Percutaneous Intervention with a Smart Flexible Needle: Design, Development and Control

M. F. Orlando, M. Kumar, P. Hutapea, A. Dicker, R. Ellis, Y. Yu, T. Podder
1 Department of Radiation Oncology, Case Western Reserve University, Cleveland, OH
2 Department of Mechanical Engineering, Temple University, Philadelphia, PA
3 Department of Radiation Oncology, Thomas Jefferson University, Philadelphia, PA

Objective:
To develop a self-actuating flexible needle for percutaneous intervention facilitating accurate target reaching while avoiding sensitive organs and anatomical obstacles.

Outline:
Several cancer interventional procedures such as, brachytherapy, biopsy, Radio Frequency based thermal ablation, anesthetic drug delivery and so on, involve precise placement of needles. Today most of these interventions are performed percutaneously. However, precise placement of the needle to a specific target inside the tissue is a difficult task. Furthermore, the involved needles are usually rigid and straight, and real-time sensory feedback of the needle is rarely available. Medical imaging and interventional delivery systems have undergone significant growth in the recent years, but the development of needles for percutaneous interventions for clinical amiability is undergoing a slow progress. Also, most of the clinically used needles are several decades old in design. Controlling the needle to reach the target precisely through a desired trajectory by the guidance of quantitative sensory feedbacks could benefit several medical procedures. Accurate and safe navigation of the needle to the desired target is the major challenge in needle based interventional techniques. Needle geometry and lack of proper actuation of the needle contribute to this major challenge. The subsequent steps after the needle reaching the target accurately are simple and they involve permanent implantation of radioactive agents (in brachytherapy) or taking samples (in biopsy) or insertion of analytical probe.

Abstract:
Introducing a needle that is both flexible and possible of moving in a curved path, can avoid accidental puncture as well as radiation exposure to sensitive body organs and anatomical obstacles other than the intended target. Therefore, a Nitinol Shape Memory Alloy (SMA) actuated flexible needle system capable of bending and steering actively to achieve the predefined curved path is developed and integrated with a robotic system aiming increase in precision and accuracy in target reaching in percutaneous interventions. Electromagnetic (EM) sensor and ultrasound image-based feedbacks are integrated in real-time closed-loop control of the needle in following desired trajectory for surgical procedures. Moreover, a variety of control algorithms using different feedback modalities are explored to deal with the system nonlinearity. Applicability of the experimental needle system has been tested in different environmental media (in-air and in-water conditions). Experimental results have revealed that the trajectory errors and control stability are within acceptable limits.

Is dosimetry of multiple met radiosurgery vendor platform dependent?

M. Saiful Huq, Y. Zhang, X. Li, J. Bhatnagar, C. Ozhasoglu, S. Burton, J. Flickinger, A. Clump, and D. E. Heron

Purpose/Objective(s):
Recent advances in commercially available radiosurgical platforms make it possible to treat a large number of intracranial lesions in a single treatment session. The goal of this project is to investigate the dosimetric differences in dose delivered to normal brain tissue and nearby critical structures that result from using different vendor platforms to treat multiple metastatic lesions.

Materials/Methods:
Seven patients with four to nine metastatic lesions distributed throughout the brain and identified using contrast-enhanced CT and MRI were selected for this study. Contours of target and critical structures were drawn on the fused CT/MRI images using the software available in the Varian Eclipse™ treatment planning system (v.11). The delineated contours and imaging studies were then digitally transferred to Accuray Multiplan® (v. 5.1) and LeksellGammaPlan® (v.10.2) treatment planning systems. Techniques used for planning are Rapid Arc™ for Eclipse™ and iris™ collimator for Multiplan®. The plans for GammaKnife were generated for delivery with the Perfection™unit. PTV volumes for the combined targets ranged from 0.80 cc to 13.40 cc. Prescription dose was 18 Gy in one fraction. Treatment plans were generated such that at least 99% of the target volume receives the prescription dose. Various dosimetric indices such as target coverage, conformity index, homogeneity index, V 12Gy, V 50Gy, maximum, minimum and mean dose to the target, maximum dose to left eye, right eye, brainstem, left and right optic nerves and chiasm, and maximum dose 3 mm away from the target were calculated. Additionally, total monitor units, beam on time and treatment times were also calculated.

Results:
Despite similar target coverage (Eclipse: greater than 99.7% of target volume received the prescription dose; Multiplan and Gamma Plan: 100% of the target received the prescription dose), there were differences in V 12Gy, V 50Gy, target dose uniformity and critical structure doses. For example, depending on the patient, the V 50Gy for Eclipse, Multiplan and GammaPlan ranged from 13.9 -58.55 cc, 13.15 – 88.0 cc and 6.14 – 72.00cc respectively. The mean and s.d. of V 50Gy for these three platforms are 29.13±17.27, 39.01±30.28 and 30.14±15.9 respectively. Results for all other dosimetric indices will be presented.

Conclusions:
The dose delivered to the normal brain using the three different platforms are dependent on which platform is used.
Transmission Factor as a Function of Patient Thickness in Portable Chest X-ray

Chris L. Liptak, BS1,2, W. Paul Segars, PhD3, Frank F. Dong, PhD1,2,4, Xiang Li, PhD1,2

1Department of Physics, 2Medical Physics Graduate Program, Cleveland State University; 3Department of Radiology, Duke University Medical Center; 4Department of Diagnostic Radiology, Cleveland Clinic; 5Doctoral Program in Applied Biomedical Engineering, Department of Chemical and Biomedical Engineering, Cleveland State University

Purpose:
Currently, portable x-ray examinations generally do not employ automatic exposure control (AEC). To aid in the design of a size-specific technique chart, acrylic slabs of various thicknesses are often used to estimate x-ray transmission factors for patients of various body thicknesses. This approach, while simple, does not account for patient anatomy, tissue heterogeneity, and the attenuation properties of the human body. To better account for these factors, in this work, we determined x-ray transmission factors using computational patient models that are anatomically realistic.

Methods and Materials:
A Monte Carlo program was developed to model a portable x-ray system. Detailed modeling was done of the x-ray spectrum, detector positioning, collimation, and source-to-detector distance. Simulations were performed for an anteroposterior projection using 18 computational patient models from the extended cardiac-torso (XCAT) family (9 males, 9 females; age range: 2-58 years; weight range: 12-117 kg). The ratio of air kerma at the detector with and without a patient model was calculated as the transmission factor.

Results:
The transmission factor decreased exponentially with increasing patient thickness. For the range of patient thicknesses examined (12-28 cm), the transmission factor ranged from approximately 25% to 2.8% when the air kerma used in the calculation represented an average over the entire imaging field of view. The transmission factor ranged from approximately 25% to 5.2% when the air kerma used in the calculation represented the average signal from two discrete AEC cells.

Conclusions:
In anteroposterior portable chest X-ray, transmission factor decreases exponentially with increasing patient thickness. These exponential relationships can be used to optimize imaging techniques for patients of various body thicknesses to aid in the design of clinical technique charts.

Conflict of Interest Statement: There is no conflict of interest to disclose.

The Impact of Input Parameter Accuracy on Monte Carlo Simulated Organ Dose in Chest CT

John S. Muryn1,2, Ashraf G. Morgan1,2,3,5, W. Paul Segars*, Chris L. Liptak1,2, Frank F. Dong1,2,6, Andrew N. Primak6, Xiang Li1,2,3

1Department of Physics, 2Medical Physics Graduate Program, Cleveland State University; 3Doctoral Program in Applied Biomedical Engineering, Department of Chemical and Biomedical Engineering, Cleveland State University; 4Department of Radiology, Duke University Medical Center; 5Department of Diagnostic Radiology, Cleveland Clinic; 6Siemens Medical Solutions USA, Inc.

Purpose:
In Monte Carlo simulation of organ dose for a chest CT scan, many input parameters are required (e.g., half-value layer of the energy spectrum, effective beam width, and patient center position). These input parameters are provided by the manufacturer, measured experimentally, or determined based on typical clinical practices. The goal of this study was to assess the uncertainties in Monte Carlo simulated organ dose as a result of using input parameter values that deviate from the truth.

Method and Materials:
Organ dose from a chest CT scan was simulated for a standard-size female phantom using a set of reference input parameter values (treated as the truth). To emulate the situation in which the input parameter values used by the researcher may deviate from the truth, additional simulations were performed in which errors were purposefully introduced into the input parameter values, the effects of which on organ dose were analyzed.

Results:
Our study showed that errors in effective beam width of up to 3 mm had only a small effect (< 2.5%) on organ dose. In contrast, when the assumed anatomical center of the patient deviated from the true anatomical center by 5 cm, organ dose errors of up to 20% were introduced. Lastly, when the assumed extra scan length was longer by 4 cm than the true value, dose errors of up to 160% were found.

Conclusion:
In Monte Carlo simulation of organ dose for a chest CT scan, organ dose is insensitive to the error in effective beam width. However, it is sensitive to the errors in the assumed patient anatomical center and the assumed extra scan length past the anatomical region of interest. The results answer the important question of to what level of accuracy each input parameter needs to be determined in order to obtain accurate organ dose results.

Conflict of Interest Statement:
There is no conflict of interest to disclose.
Monte Carlo Comparison of Absorbed Dose Delivered to Non-Targeted Tissues during Stereotactic Radiosurgery, Brachytherapy, and Proton Radiation Therapy for Age-Related Macular Degeneration

Authors: Justin Cantley, Erik Chell, Justin Hanlon, Inder Daftari, Wesley E. Bolch
Affiliation: University Hospitals of Cleveland/Case Western Reserve University

Purpose:
Age-related macular degeneration (AMD) is a leading cause of vision loss for the elderly of industrialized nations. Improvements in targeting have led to more options for radiation-based treatment of the disease. Three types of radiotherapies – brachytherapy, kilovoltage stereotactic radiosurgery, and proton – are presented in this study to determine their viability to treat AMD in regards to non-targeted tissues of the eye.

Methods:
Stylized models of the eye were created with axial lengths of 20, 22, 24, 26, and 28mm. Each model was based upon the reference eye model from NCRP Report 130 and then scaled appropriately by axial length. The Monte Carlo radiation transport package MCNPX was used to determine the absorbed dose to six non-targeted tissues of the eye: ciliary body, total lens, sensitive volume of the lens, retina, optic nerve, and the distal tip of the central retinal artery. Simulation results were assessed using dose-volume histograms (DVHs).

Results:
For each type of radiotherapy, DVHs were constructed based upon a target dose of 24 Gy to the macula. All three radiotherapies resulted in doses to non-targeted tissues below suggested thresholds, with the lowest doses seen with brachytherapy. The data showed no significant variation due to the eye size for any of the three radiotherapies.

Conclusions:
Absorbed doses to non-targeted tissues of the eye show that all three of the proposed radiotherapies are viable treatments for AMD, with brachytherapy able to achieve the most desirable dosimetric results. The small variation in dose to non-targeted eye tissues suggests that eye size does not significantly affect absorbed dose.

This work was sponsored by Oraya Therapeutics.

Comprehensive Evaluation of Three Deformation Image Registration Algorithms Using Digital Phantoms Created from Patients with Head and Neck Cancer

Zhilei Liu Shen 1, Karl Bzdusek 2, Qingyang Shang 1, Ping Xia 1
1 Cleveland Clinic, Cleveland, OH, 2 Philips Healthcare, Fitchburg, WI

Purpose:
To create digital phantoms using paired planning and replanning CTs from patients with H&N cancer and to comprehensively evaluate three commonly-used deformable image registration (DIR) algorithms with known ROIs and volumetric doses from the established phantoms.

Materials and Methods:
Ten H&N cancer patients with adaptive radiotherapy were retrospectively selected. For each patient, a pair of planning CT (pCT) and replanning CT (rCT) was used as the basis for digital phantom creation. Manually adjusted meshes were generated for selected physician approved ROIs. The corresponding mesh vertices were input into a thin-plate spline algorithm to generate a “ground truth” displacement vector field (DVF). The DVF was used to deform the pCT to generate a simulated replanning CT (srCT) that was closely matched to the rCT. The digital phantom consisted of the pCT and srCT, which were linked by the known DVF. Three DIR algorithms (Fast-Symmetric Demons, B-Spline, and MIM) were applied to these ten digital phantoms. The images, ROIs, and volumetric doses were mapped from the pCT to the srCT using the DVFs computed by these three DIRs and compared to those mapped using the known DVF.

Results:
The average normalized cross-correlation (NCC) value between pCT and rCT with rigid registration was 0.922, indicating large anatomical changes. The NCC values between srCT and rCT were improved to 0.974, 0.997, and 0.997, with B-spline, FS Demons, and MIM, respectively. The mean Dice coefficients of selected ROIs (e.g. PTV, brainstem, spinal cord, mandible, parotids) were in the range of 0.84-0.98, 0.90-0.98, and 0.88-0.98 for B-spline, FS Demons, and MIM, respectively. The average slice-wise Hausdorff distances of selected ROIs were in the range of 2.1-6.3 mm, 1.6-5.2 mm, and 2.0-7.0 mm for B-spline, FS Demons, and MIM, respectively. The average absolute dose errors of selected ROIs were in the range of 0.1-2.2 Gy, 0.1-1.0 Gy, and 0.1-0.9 Gy for B-spline, FS Demons, and MIM, respectively.

Conclusion:
All three DIR algorithms were comparable with FS Demons and MIM slightly better than B-spline. The deformed images, ROIs, and volumetric doses obtained by these three DIRs agreed well with those mapped from the known DVF.

Conflict of Interest: ZLS: None; KB: Employee, Philips Healthcare Inc.; QS: None; PX: None.
Minimum practice standards in clinical medical physics

Abstract:
Recent coverage in the mainstream media has brought significant attention to the uses of ionizing radiation in medicine. This is not a transient concern, however. The past two decades have seen an increasing focus on reducing medical errors and validating professional competence. Federal and state regulatory and legislative bodies have become increasingly assertive in defining minimum standards in imaging and radiation therapy, whether through regulation, licensure or payment policies such as the CMS accreditation requirements in MIPPA. The AAPM, ACR, and ASTRO have publicly advocated for linking CMS reimbursement to a requirement for accreditation of all imaging and radiation oncology clinics. ASTRO has led a series of White Papers on patient safety in radiation oncology, culminating in the 12-society collaborative document titled “Safety is No Accident” which was recently published. The AAPM has embarked on an ambitious effort to develop Medical Physics Practice Guidelines, to define the minimum level of medical physics support deemed appropriate for a range of clinical services. This presentation will review how the convergence of the aforementioned initiatives can contribute to improvements in patient safety in imaging and radiation oncology, and how the AAPM and the medical physics community can shape the framework of practice standards pertaining to clinical medical physics.

Educational objectives:
At the end of this presentation, participants will:
1. Understand the convergence of external factors that are driving the trend toward minimum practice standards in clinical medical physics;
2. Be aware of the combined effect of practice accreditation programs and payor policies in shaping the clinical medical physics practice environment of the near future;
3. Understand the purpose and intended scope of the AAPM’s Medical Physics Practice Guidelines; and
4. Understand the considerations regarding appropriate supervision levels in clinical medical physics.

Outline:
I. Review of external factors influencing practice standards in imaging and radiation oncology.
II. Review of accreditation programs in imaging and radiation oncology and the practice standards described in these accreditation programs.
III. Detailed description of AAPM Medical Physics Practice Guidelines (MPPGs): purpose, intended scope, development and approval process, publication method, inter-society collaboration. Contrast MPPGs with Task Groups.
IV. Overview of professional supervision as applied to clinical medical physics and the AAPM’s current status in developing professional policy and guidance.
Invited Speakers

Kristy K. Brock, PhD, DABR - Associate Professor
DEPT of Radiation Physics
University of Michigan
1500 E MEDICAL CENTER DR

Practical Guidance for Commissioning and Clinical Implementation of Deformable Image Registration

Educational Objectives:
Participant should be able to:

1. Highlight the importance of understanding the image registration techniques used in their clinic.
2. Describe the end-to-end tests needed for stand-alone registration systems.
3. Illustrate a comprehensive commissioning program using both phantom data and clinical images.
4. Describe a request and report system to ensure communication and documentation.
5. Demonstrate an clinically-efficient patient QA practice for efficient evaluation of image registration.

Outline:

I. Brief review of image registration techniques
II. Understanding the importance of algorithm implementation
III. Techniques to assess image registration
IV. Recommendations for image registration commissioning
V. Use of a request and report system

Ravi Kulasekere, PhD
Director of Clinical Physics
Radiation Oncology
MetroHealth Medical Center

Wading through the Task Group Matrix at a community hospital - The Metro Health Experience

Educational Objectives:
Participant should be able to:

1. Quality Assurance Protocols of the AAPM recommended for Radiotherapy Facilities
2. Discuss how to best implement these protocols in small or community hospitals with limited resources

Outline:

VI. Introduction to quality assurance in radiation therapy
VII. Introduction to the AAPM Protocols for quality assurance
VIII. Issues faced with implementing some or all of these protocols in small clinics or community hospitals
IX. Discuss how Metro Health, a small community hospital, approached this dilemma during the renovation and upgrade of their cancer center in 2012

Topics of Interest
How AAPM Task Groups (TGs) are born

Small Field Dosimetry

Radiation Therapy: The State of the Art and the Future

Safety is not a Task: The RO•ILS Initiative in the Matrix

Rationale for Modern Radiation Oncology/Hypofractionation and SBRT

**Educational objectives:**

1. To understand why hypofractionation is possible with highly conformal radiotherapy.
2. To understand how the linear-quadratic model can be used to demonstrate the effect of radiobiological parameters which we can control for radiotherapy.
3. To understand why hypofractionation might be appropriate for certain cancers but not for others.
4. To know what clinical trials are being conducted to study hypofractionation.

**Outline:**

Firstly, we will review why we fractionate at all, looking first at physical reasons then at the radiobiological aspects. Mechanisms by which radiation kills cells and ways cell damage can be repaired will be reviewed. We will show that there is a “Window of Opportunity” at low doses/fraction within which we can control cancers without exceeding normal tissue tolerance. We will then show how the use of highly conformal radiotherapy such as stereotactic body radiotherapy (SBRT) widens this “Window of Opportunity” so that we can use higher doses/fraction and hence hypofractionation. Using the linear-quadratic model we will show the effect of radiobiological parameters which we can control for radiotherapy including dose/fraction, number of fractions, time between fractions, and overall treatment time. We will discuss which types of cancers might benefit most from hypofractionation and review some potential caveats that might reduce the effectiveness of hypofractionation and, possibly, make it inappropriate for some cancers. Finally, we will review some clinical trials aimed at deciding if hypofractionation is the best treatment for certain cancers.
Radiation Response of Brain Tumors and Normal Tissue after Stereotactic Radiosurgery

David A. Clump II, MD, PhD, is a radiation oncologist specializing in head and neck malignancies and stereotactic radiosurgery.

Dr. Clump received his medical degree from the West Virginia University School of Medicine, and completed his residency in radiation oncology at UPMC.

Dr. Clump is a member of the American Society of Therapeutic Radiation Oncology, American College of Radiation Oncology, and American Board of Radiology.

Education of State Regulators

Educational objectives:
1. Present some history of the Medical Event rule
2. Discuss some problems with Interpretation for Multi-fraction Radiation Therapy
3. Discuss recent Changes in the NRC Prostate Seed rule
4. Suggested Changes to the Rule for External Beam Radiation Therapy

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