SCIENTIFIC PAPERS

SCIENTIFIC SESSION #1
CNS Tumors

Moderators
Mark Henderson, MD; Indiana University School of Medicine
Raymond Sawaya, MD; UT MD Anderson Cancer Center

(S001) Survival Advantage With Everolimus (RAD001) Combined With a Selective BRAFV 600E Inhibitor in a Xenograft Model of BRAFV 600E-Mutated Pediatric Glioma
Tina Dargupta, MD, PhD – TRAVEL GRANT WINNER

(S002) Patterns of Failure for Glioblastoma Multiforme Following Limited-Margin Radiation and Concurrent Temozolomide
Brian J. Gebhardt, BA

(S003) Temozolomide Use in Adult Patients With Gliosarcoma: An Evolving Clinical Practice
Gary V. Walker

(S004) Surgical Excision With Adjunct External Beam Radiation, Temozolomide, and Anti-EGFR Radioimmunotherapy in Treatment of High-Grade Gliomas: A Phase II Study
Michael Wong

(S005) Effect of Treatment Modality on the Hypothalamic-Pituitary Function of Patients Treated With Radiation Therapy for Pituitary Adenomas: Effect of Hypothalamic Dose on Endocrine Outcomes
Andrew Elson, MD

(S006) Phase I Preliminary Results of Intraoperative Brachytherapy for Recurrent Glioblastoma Multiforme (GBM) and Atypical Meningioma
A. Gabriella Wernicke, MD, MSc

(S007) Brain Metastases in Patients Diagnosed With a Solid Primary Cancer During Childhood: Experience From a Single Referral Cancer Center
Raymond Sawaya, MD

(S008) A Prospective Study Using Implanted Fiducial Markers to Assess Treatment Accuracy in Spinal Stereotactic Body Radiation Therapy
David C. Weksberg, MD, PhD

(S009) Outcomes in Spinal Stereotactic Body Radiotherapy: An Update of the MD Anderson Cancer Center Experience
E.N. Christensen, MD, PhD

SCIENTIFIC SESSION #2
Imaging

Moderator
Alan Pollack, MD, PhD; University of Miami

(S010) Variation in Dose to Organ at Risk, Due to Daily Rectal Filling During Prostate Intensity-Modulated Radiotherapy: A Cone-Beam CT Study
Leonel A. Kahn, BS

(S011) 18F-FDG PET Definition of Gross Tumor Volume in Pediatric Hodgkin Lymphoma: What Is the Effect of Various SUV Thresholds on Target Volume Delineation?
Minh-Phuong Huynh-Le, BS – TRAVEL GRANT WINNER

(S012) PET as a Predictor of Outcomes for Cervical and Vaginal Cancer With HDR Interstitial Brachytherapy Utilizing MRI-Based Planning
J.M. Freilich, MD

(S013) Noninvasive Real-Time Prostate Tracking Using a Transperineal Ultrasound Approach: Phantom Studies and Initial Clinical Experience
Matthew C. Abramowitz, MD

(S014) Improving Prostate Cancer Risk Stratification Through Multiparametric MRI Prostate Imaging
Nicolas T. Kummer, MD, PhD

(S015) Extent of Perilesional Edema Differentiates Radiocellular From Tumor Recurrence Following Stereotactic Radiosurgery for Brain Metastasis
Peyman Kabolizadeh, MD, PhD – TRAVEL GRANT WINNER

(S016) Optimizing Reconstructive Outcomes in the Radiated Head and Neck Cancer Patient: A Novel Application of Indocyanine Green Angiography
Ryan Winters, MD

SCIENTIFIC SESSION #3
Head and Neck Cancer

Moderators
Beth Beadle, MD, PhD; UT MD Anderson Cancer Center
Drew Ridge, MD, PhD; Fox Chase Cancer Center

(S017) Initial Clinical Outcomes of Dose-Escalated Proton Therapy for Head and Neck Adenoid Cystic Carcinoma
Okechukwu Linton, MD – TRAVEL GRANT WINNER
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Emerging Biologic and Cell-Based Markers

Moderators
Quynh-Thu Le, MD; Stanford University
Sue Yom, MD, PhD; University of California, San Francisco

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Aaron J. Grossberg, PhD

Scientific Session #6
Breast Cancer

Moderator
Meena S. Moran, MD; Yale University School of Medicine

Prognostic Significance of Ki-67 Expression in Women Treated With Breast Conservation Therapy (BCT)
Farhaan Hafeez, MS – Travel Grant Winner

Scientific Session #7
Gastrointestinal / Genitourinary Cancer

Moderators
Matthew C. Abramowitz, MD; University of Miami
Joseph Herman, MD; Johns Hopkins University

Safety and Efficacy of Stereotactic Body Radiotherapy for Liver Metastasis
Benjamin Goodman, DO – Travel Grant Winner
(S010) Variation in Dose to Organ at Risk, Due to Daily Rectal Filling During Prostate Intensity-Modulated Radiotherapy: A Cone-Beam CT Study

Leone A. Kahn, BS, Arthur Y. Hung, MD, Barbara Agrimson, BS, CMD, Sanja Ognjenovic, Tussee S. Doshi, Halkene M. Genechuk, Catherine M. Kato, Lu Z. Meng, PhD, Anna O. Simeonova, MD, James A. Tanyi, PhD: Department of Radiation Medicine, Oregon Health and Science University; Oregon State University; Stanford University; George Fox University; Macalester College; University of California, Davis; University of Heidelberg

PURPOSE: Rectal interfraction motion during prostate radiotherapy has been demonstrated previously, but the dosimetric implications of this phenomenon are not well delineated. The current study aims to: (1) characterize the values of and evaluate daily trends in the rectal volume, rectal anterior-posterior translation, and volume of the rectum receiving 45 Gy, 65 Gy, and 70 Gy (V40/V65/V70) and (2) assess for correlation between the interfraction motion parameters and the dosimetric data.

MATERIALS AND METHODS: Sixteen patients undergoing intensity-modulated radiotherapy of the prostate were retrospectively reviewed. Enemas were used prior to simulation. No bowel preparation was performed prior to daily treatment. The outer walls of the rectum were contoured on all on-treatment CBCT series for each patient. Daily rectal volume changes; displacement of the anterior rectal wall at three levels; and rectal V45, V60, and V70 were reported. Pearson coefficients were used to determine trends in each rectal volume/translation/dose-volume histogram (DVH) value versus fraction number and between translation change versus DVH and volume change versus DVH.

RESULTS: At the superior, isocenter, and inferior rectal level, five, two, and three patients, respectively, had anterior-posterior translations of greater than 0.6 cm. No statistically significant correlation between the translational motion of the rectum and the fraction number was noted for any patient at any rectal level (all Pearson coefficients < 0.75). All but one patient had mean volume changes of greater than 30 cc. No statistically significant correlation between the fraction volume changes and the fraction number was noted for any patient (all Pearson coefficients < 0.75). All 16 patients had a mean V70 < 17%, a mean V65 < 25%, and a mean V40 < 35%. Fourteen of 16 patients had mean V40, V65, and V70 values that were > 2 standard deviations less than the rectal tolerance values of V70 ≤ 17%, V65 ≤ 25%, and V40 ≤ 35%. Thus, for all but two patients, 97.8% of the fractions delivered met the rectal tolerance criteria at each dose level in the absence of any rectal preparation or instructions. No statistically significant correlation between the fraction number and the rectal V40/V65/V70 values, respectively, was noted for any patient (all Pearson coefficients < 0.75). Correlations were found between rectal V40, V65, and V70 and rectal superior/isocenter/inferior translational motion (31.3%/37.5%/0% of cases, respectively), as well as volume change (87.5% of cases).

CONCLUSIONS: The lack of correlation between the rectal DVH values and the treatment fraction number underscores the random nature of the variation in the rectal DVH. Thus, it is not practical to create a population-based algorithm, applicable to all patients, to ensure reproducible daily rectal DVH parameters. However, rectal DVH values remained under the tolerance limits during the majority of fractions delivered, despite volume and translational changes. Thus, multiadaptive planning to accommodate independent prostate and rectal motion is not needed to improve daily rectal DVH compliance. Only select patients may attain improved rectal DVHs from techniques aimed at maintaining a constant rectal volume. Our results do not obviate the need for daily image-guided RT for prostate motion correction.

(S011) 18F-FDG PET Definition of Gross Tumor Volume in Pediatric Hodgkin Lymphoma: What Is the Effect of Various SUV Thresholds on Target Volume Delineation?

Amanda J. Walker, MD, Stephanie A. Terezakis, MD, Alin Chirindel, MD, Steve Cho, MD, Minh-Phuong Huynh-Le, Moody D. Wharam, MD, The Johns Hopkins Hospital

PURPOSE/OBJECTIVES: Accurate target volume delineation in Hodgkin lymphoma (HL) is becoming more important as radiotherapy moves toward more conformal techniques. FDG-PET imaging is used in staging and management of HL and may also be used as a planning tool for radiotherapy. A limitation of FDG-PET in radiation planning for HL is significant variability in interpretation of tumor volume and edge detection, and the best method to incorporate functional PET data into RT planning is still a matter of debate. One approach to reduce variability is to apply automatic or semiautomatic segmentation methods, such as thresholding based on maximum SUV. Accepted SUV max cutoffs range between 15% and 40%. Here, we apply various SUV max thresholds in treatment planning and examine their effects on clinical target volumes in involved-field radiation therapy (IFRT) and involved-node radiation therapy (INRT).
(S023) Role of TGF-Beta Signaling in PIK3CA-Driven Head and Neck Cancer Invasion and Metastasis

Sophia Bornstein, MD, PhD; Jingjing Shen, MD, PhD; Frank Hall, BS; Sherif Said, MD, PhD; Xiao-Jing Wang, MD, PhD; Neil Gross, MD; John Song, MD; Natalie Serkova, PhD; Shi-Long Lu, MD, PhD; Department of Otolaryngology, Department of Radiation Medicine, Oregon Health & Science University; Departments of Otolaryngology, Pathology, Anesthesiology, University of Colorado Anschutz Medical Campus, Aurora

BACKGROUND: Head and neck squamous cell carcinoma (HNSCC) patients have a poor prognosis, and mortality is linked to metastatic spread. However, the molecular mechanisms of HNSCC invasion and metastasis are unclear. The phosphatidylinositol 3-kinase (PI3K) pathway regulates a wide range of cellular processes crucial for tumorigenesis. Amplification and mutation of PIK3CA, the gene coding for the catalytic subunit of PI3K, are among the most common genetic alterations in human HNSCC.

METHODS AND RESULTS: To delineate the in vivo roles of PIK3CA during head and neck tumorigenesis, we developed a PIK3CA genetically engineered mouse model (GEMM), in which PIK3CA overexpression is specifically induced in the head and neck epithelia. When we applied 4NQO, a DNA adduct-forming agent widely used as a tobacco surrogate, together with PIK3CA overexpression, the PIK3CA-GEMM developed ~50% poorly differentiated HNSCC compared with ~10% in the control mice. Additionally, 40% of 4NQO-treated PIK3CA-GEMM developed metastases compared with 0% in control 4NQO-treated mice. PIK3CA-GEMM tumors showed evidence of epithelial–mesenchymal transition (EMT) with strong vimentin staining and Twist overexpression. Molecular analysis of the PIK3CA tumors suggests that rather than AKT, PDK1 facilitates progression of PI3K-driven HNSCC, potentially through increased TGF-beta signaling. Supporting this hypothesis, PIK3CA tumors expressed increased TGF-beta1 ligand and Smad3, which is associated with TGF-beta–mediated inflammation, angiogenesis, and EMT based on our previous work.

CONCLUSIONS: In summary, our results suggest that the PIK3CA oncogene drives invasion and metastasis of HNSCC through PDK1, possibly through activation of downstream TGF-beta signaling. Combined targeting of these pathways could inhibit cancer progression and metastasis in HNSCC patients with PIK3CA alterations.

(S024) Locoregional Recurrence Risk for Patients With T1,2 Breast Cancer With 1–3 Positive Lymph Nodes Treated With Mastectomy and Systemic Treatment

Andrew McBride, Pamela Allen, PhD; Wendy W. Woodward, MD, PhD; Michelle Kim, MD; Henry Quer, MD, PhD; Eva Katherine Drinka, MD; Ayesegul Sahin, MD; Eric Strom, MD; Aman Buzdar, MD; Vicente Valero, MD; Gabriel Hortobagyi, MD; Kelly Hunt, MD; Thomas Buchholz, MD; University of Arizona; UT MD Anderson Cancer Center

BACKGROUND/PURPOSE: Randomized trials suggest breast cancer patients with 1–3 positive lymph nodes achieve benefits from postmastectomy radiation (PMRT). However, significant changes in breast cancer management, such as the use of sentinel lymph node surgery and improvements in systemic treatments, have occurred since the conclusion of these trials. We undertook this study to compare the benefits of PMRT in an era prior to and after these changes in breast cancer management.

METHODS: We retrospectively analyzed the locoregional recurrence (LRR) rates of 1,031 patients with a T1,2 breast cancer with 1–3 positive lymph nodes treated with mastectomy and adjuvant chemotherapy with or without PMRT during an early era (1978–1997) and a later era (2000–2007). These eras were selected because they represented periods prior to and after the routine use of sentinel lymph node surgery, taxane chemotherapy, and aromatase inhibitors. To define higher-risk subgroups, we also evaluated the risk factors for LRR for patients who did not receive PMRT.

RESULTS: A total of 506 patients were treated in the early era, 98 (19%) of whom received PMRT, and 522 patients were treated in the later era, 137 (26%) of whom received PMRT. In both cohorts, patients who received PMRT had significantly higher risk disease features. On the basis of our previous studies, we used PMRT more frequently for patients with three positive lymph nodes, T2 tumors, or gross extracapsular extension in the later cohort. PMRT was associated with a lower LRR rate in the early era cohort but not the later era cohort. Specifically, the 5-year LRR rate for patients in the early cohort was 9.5% without PMRT and 3.3% with PMRT (log-rank P = .028, 15-year rates 14.5% vs 6.1%, respectively), whereas the 5-year LRR rates of the later cohorts were 2.8% without PMRT and 4.2% with PMRT (P = .48). A Cox regression analysis of the early cohort revealed radiation use to be a significant factor predictive of LRR (adjusted hazard ratio AHR) = 0.37; P = .035. In contrast, in the later cohort, radiation was not sig-
This study sought to identify the cell type mediating IL-1β-induced fatigue and anorexia, to inform therapeutic approaches to these toxicities of radio- and chemotherapy.

**MATERIALS AND METHODS:** The Nestin-cre mouse was crossed with MyD88Δesp mice to delete MyD88 from neurons and glia in the CNS (MyD88ΔCNS). These mice were compared with total body MyD88KO and wild type (WT) mice. Mice had cannulae stereotactically placed in the lateral ventricle and telemetry transponders implanted into the peritoneum. Mice were treated with either intracerebroventricular (ICV) IL-1β (10 ng) or vehicle. Food intake, body weight, and LMA were continuously monitored for 24 h after treatment. ICV TNF (500 ng), a non–MyD88-dependent cytokine, was used as a positive control for normal immune development. Peripheral inflammation was modeled using IP lipopolysaccharide (LPS). Efficacy of recombination was evaluated using tdTomato reporter mice crossed with the Nestin-cre mouse.

**RESULTS:** ICV IL-1β treatment caused a significant reduction in feeding, body weight, and LMA in WT mice. MyD88KO mice were protected from these effects of ICV IL-1β despite having intact behavioral responses to TNF. Nestin-cre/tdTomato reporter mice exhibited recombination in neurons and astrocytes but not microglia or endothelial cells. In contrast to MyD88KO mice, the behavioral responses of MyD88ΔCNS mice to ICV IL-1β or IP LPS were indistinguishable from those of WT mice.

**CONCLUSIONS:** Our results demonstrate that MyD88 is not required in neurons or astrocytes to induce the behavioral response to ICV IL-1β. This suggests that a non–Nestin-expressing cell population responds to IL-1β in the CNS and transduces the signal to neurons controlling feeding and activity. We posit that cerebrovascular cells are the most likely targets for IL-1β signaling in the brain, implying that systemic therapy addressing anorexia and fatigue need not penetrate the blood-brain barrier.

**S030 Developing a Circulating Tumor Cell Assay for Non-Small-Cell Lung Cancer Patients Undergoing Radiation Therapy**

Lucas Gilbride, Jay R. Dorsey, Sanjay Chandrasekaran, Kelly M. MacArthur, Christina H. Chapman, Joel R. Concepcion, Gary D. Kao, Stephen M. Hahn; Department of Radiation Oncology, University of Pennsylvania

**BACKGROUND:** Non–small-cell lung cancer (NSCLC) is the most common cause of cancer mortality in the United States, with systemic disease and relapse frequent despite definitive therapy. Circulating tumor cell (CTC) assays provide noninvasive and serial interrogations of the status of primary or metastatic NSCLC disease, thus potentially guiding treatment decisions and reflecting prognoses. Substantial technical constraints have impeded efforts with CTC assays based on cell surface markers. We therefore employed a novel approach based on the detection of elevated telomerase activity inherent in tumor cells. This method affords maximal sensitivity, as it is not affected by epithelial-mesenchymal transition (EMT) in cancer cells, and maximal specificity, as among normal cells, only stem cells show activated telomerase. We describe here pilot results with this assay and plans for a more extensive prospective study involving multiple NSCLC patient cohorts.

**PATIENTS AND METHODS:** The feasibility of a telomerase-based method of CTC detection in an NSCLC cancer population was explored in a pilot study of 23 patients enrolled in the tissue collection/registry protocol in the Department of Radiation Oncology. Patients included in the CTC pilot study had biopsy-proven NSCLC and were treated with definitive radiotherapy (RT) as a part of their treatment regimen. CTC analysis was performed on a 10-mL blood sample collected from the patient before, during, and after completion of the RT treatment course. The CTC assay relies on an adenoviral vector expressing the hTERT promoter, which thus drives expression of green fluorescent protein only in the presence of elevated telomerase activity.

**RESULTS:** Of 23 patients with NSCLC, elevated CTC counts were found in all but 1 patient, with the levels of CTCs detected per mL of blood ranging from 0.57 cells to 570.7 cells (mean 62.7, median 9.1, standard error [SE], 28.4). In contrast, the rate of background non-CTC cells detected in four normal healthy controls ranged from 0.1–1.7 (mean 0.76, median 0.72). CTC counts in all but one NSCLC patient decreased as a result of RT, with marked decreases in some. The only patient who did not show a decrease in CTC counts was soon found to have developed new metastases. Representative and notable examples of patient serial CTC counts will be presented.

**CONCLUSIONS:** In a pilot study, we have demonstrated the feasibility to detect CTCs in patients with NSCLC utilizing a novel telomerase-based assay system, with encouraging data showing a reduction in CTC counts in most patients undergoing RT. The assay may thus contribute to: a) predicting response to treatment, b) monitoring response to therapy, and c) early detection of relapse and disease progression. Guided by these promising results, we have initi-
Symptomatic patients with multiple eNO flow measurements had elevated $J_{\text{NO}}$ but not $C$, at the end of radiotherapy compared with preradiotherapy ($P = .02$).

CONCLUSIONS: Elevation in exhaled nitric oxide was found to be predictive of symptomatic radiation pneumonitis in esophageal cancer patients receiving thoracic radiotherapy, with a high specificity, positive predictive value, and negative predictive value but low sensitivity. An increase in eNO was not predictive of radiation pneumonitis symptoms in lung cancer patients, however. Furthermore, the ability of eNO to predict respiratory symptoms in esophageal cancer patients undergoing radiation therapy may be related to elevations in bronchial airway NO production, as increased bronchial airway NO flux was also associated with symptomatic radiation pneumonitis.

(S050) Are Insurance Companies Influencing the Decision-Making Process for Stage I Non-Small-Cell Lung Cancer (NSCLC) Patients?

Daniel M. Arsenaugh, MD, Brian E. Lally, MD, University of Miami, Sylvester Cancer Center

PURPOSE/OBJECTIVES: Recently, there have been advancements in the delivery of radiotherapy that have resulted in two different treatment options with equal efficacy for stage I non–small-cell lung cancer (NSCLC) patients: surgery and stereotactic body radiotherapy (SBRT). Given that lung cancer is the leading cause of cancer death in the United States, an identification of any disparity in access to care could potentially impact millions of people. To date, little information regarding the impact of insurance type on treatment decisions for stage I NSCLC patients exists. Understanding such an implication is of particular importance in this time of health care reform. As the Affordable Care Act takes effect in the coming months, the insurance demographics of patients in the United States will undoubtedly change.

MATERIALS AND METHODS: In this analysis, we used the Florida Cancer Data System (FCDS) to create a cohort of pathologically confirmed stage I NSCLC patients. Patients were included if they had complete information on date of diagnosis, type of insurance (uninsured, insured, Medicare, or Medicaid), and treatment (surgery or SBRT). The chi-square test was used to statistically assess the differences between the groups examined.

RESULTS: A total of 41,470 stage I NSCLC patients were identified between 2005 and 2010. Of this group, 1,379 (3.33%) patients were uninsured, 13,100 (31.6%) were insured, 24,635 (59.4%) had Medicare, and 2,356 (5.7%) had Medicaid. A total of 13,737 patients were treated with surgery, and of this group, 246 (1.8%) patients were uninsured, 4,612 (33.6%) patients were insured, 7,975 (58.1%) patients had Medicare, and 899 (6.5%) patients had Medicaid. A total of 224 patients were treated with SBRT; 2 (0.9%) of these patients were uninsured, 33 (14.7%) patients were insured, 127 (56.7%) patients had Medicare, and 62 (27.7%) patients had Medicaid. There was a statistically significant different usage of treatment modality with respect to insurance status ($P < .0001$).

CONCLUSION: We found a statistically significant difference in treatment modality with respect to insurance status in this cohort of stage I NSCLC patients. Insured patients are more likely to receive surgical treatment, and Medicaid patients are more likely to receive SBRT. Longer follow-up and clinical correlation are needed to determine the clinical significance of this finding, but work is needed to ensure that there is no disparity in access to treatment options. It is imperative that treatment decisions are patient-centered and not influenced by patient insurance.

(S051) Interfraction Stability of Electromagnetic Navigational Bronchoscopy-Placed Embolization Coil Fiducial Markers for Lung Stereotactic Body Radiation Therapy (SBRT)

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INTRODUCTION: SBRT has become a standard of care for patients with early-stage inoperable non–small-cell lung cancers. Commonly, transthoracic-placed gold fiducial markers are utilized as positional surrogates for the lung lesion in pretreatment image guidance. Thus, stable fiducial positioning is essential for effective and safe treatment delivery. However, studies have shown a high dislocation rate of linear gold seeds prior to first radiation treatment, necessitating more reliable markers. Also, pneumothorax rates as high as 23% have been associated with transthoracic procedures. Electromagnetic navigational bronchoscopy (ENB) is a minimally invasive, CT-based localization device that navigates the bronchoscope to peripheral lesions previously inaccessible to traditional bronchoscopy. Our institution has been utilizing libered platinum embolization coils (Vorix-35, Boston Scientific) as fiducial markers, owing to their perceived ability to anchor in small bronchi and soft tissues better. This is the first study to assess the stability of the interfraction position of ENB-placed embolization coil markers throughout courses of SBRT.
between Gold and Calypso patients treated with sIMRT. Relative to the baseline and compared with the Gold patients, mean AUA BPH score in Calypso patients was 1.54 points lower at 6 months, 2.94 points lower at 12 months, 2.42 points higher at 18 months, and 0.30 points higher at 24 months. Similar but statistically nonsignificant changes in the mean AUA BPH score were observed in hIMRT patients. Both Gold and Calypso cohorts experienced a substantial increase in nocturia at the end of treatment. Calypso patients had a 0.3-point greater increase in mean nocturia score at the end of treatment compared with Gold patients; however, this difference was not statistically significant. No significant difference in mean nocturia scores across time was found between the Gold and Calypso cohorts. The prevalence of α-blocker use at the end of treatment was estimated to be 18 pp greater (95% confidence interval [CI] = 2–34 pp greater) in Gold patients compared to Calypso patients when treated with sIMRT, with no significant difference at baseline and other time points.

CONCLUSIONS: The trends of change in AUA BPH scores over time, relative to baseline, and the difference in prevalence of α-blocker use suggest lower short-term and longer-term urinary toxicity of real-time tumor tracking with the Calypso system compared to the use of gold fiducials. However, the magnitude of this difference is clinically small.

(P021) High-Dose-Rate Brachytherapy With or Without Intensity-Modulated Radiation Therapy for a Local Recurrence of Prostate Cancer

Tobin Strom, MD, Richard B. Wilder, MD, Daniel Fernandez, MD, PhD, Matthew C. Biagioli, MD; H. Lee Moffitt Cancer Center

INTRODUCTION: Few articles have been published on brachytherapy as salvage therapy for recurrent prostate cancer after prostatectomy. We hypothesized that high-dose-rate (HDR) brachytherapy ± intensity-modulated radiation therapy (IMRT) could effectively treat patients with a local recurrence of prostate cancer.

METHODS: From October 2009 to July 2012, we treated three patients with a local recurrence after radical prostatectomy with HDR brachytherapy ± IMRT. Recurrent prostate cancer was defined based on the NCCN definitions of detectable postprostatectomy prostate-specific antigen (PSA) or postprostatectomy PSA ≥ 0.1 ng/mL that increases on two subsequent measurements. All three patients initially underwent prostatectomy with negative margins. No patients had extraprostatic extension, one patient had seminal vesicle invasion, and two patients had a PSA that was initially detectable after prostatectomy. The median pre-HDR PSA value was 0.6 ng/mL (range: 0.3–2.3 ng/mL). The median time from prostatectomy to salvage HDR treatment was 116 months (range: 25–194 months). A pelvic MRI, CT, or PET scan demonstrated an identifiable mass in the prostate bed with no regional (nodal) or distant metastases. Two patients had recurrences > 2 cm in the prostate bed and were treated with two 950-cGy fractions of HDR brachytherapy and 4,500 to 5,040 cGy in 25 to 28 fractions of IMRT to the prostate bed, one of whom also received androgen deprivation therapy (ADT). The third patient had a palpable 5-cm recurrence in the left seminal vesicle and underwent HDR brachytherapy consisting of four 950-cGy fractions and ADT but no IMRT. Rectal toxicities were graded according to the Common Terminology Criteria for Adverse Events, version 4.

RESULTS: At a median follow-up of 22 months, all three patients have undetectable PSA levels. The two patients who were initially on ADT have been able to stop the therapy. No patients report late grade 1 or higher rectal toxicities.

CONCLUSIONS: HDR brachytherapy ± IMRT is an option for salvage therapy after prostatectomy for patients with a local recurrence and no regional or distant metastases, and it deserves further study.

(P022) Dosimetric and Body Mass Index Analysis of Polyethylene Glycol Gel in Prostate Cancer Patients Undergoing Radiotherapy

Tobin Strom, MD, Matthew C. Biagioli, MD, Daniel Fernandez, MD, PhD, Richard B. Wilder, MD; H. Lee Moffitt Cancer Center

INTRODUCTION: Use of a gel to increase the distance between the rectum and prostate decreases the radiation dose delivered to the rectum in prostate cancer patients undergoing high-dose-rate (HDR) brachytherapy ± intensity-modulated radiation therapy (IMRT). One group reported that men with a lower body mass index (BMI) have less fatty tissue between the rectum and prostate and consequently receive a higher rectal wall dose from brachytherapy. Based on this report, we hypothesized that BMI would correlate with rectal-prostate distance, rectal V75, and rectal D2cc.

METHODS: Between May 2010 and October 2012, we treated 125 clinically localized prostate cancer patients with HDR brachytherapy ± IMRT ± polyethylene glycol gel. Low-risk and favorable intermediate-risk patients under-
METHODS: The records of Indiana University Cyclotron Operations (IUCCO) and IU Health Proton Therapy Center (IUHPTC) were screened to describe used aperture disposal policies. Close to 2,000 patient-specific devices per year are used that require proper guidelines for disposal. Processes for storage and waste recovery are outlined to minimize safety risk.

RESULTS: IUCCO practice has been to store these apertures for at least 4 months in a secure place to allow for safe transfer to recycling contractors. Over 150 apertures are utilized each month at IUHPTC. They require decay in two staged secure locations, including at least 4 months in a separate building, at which point half are ready for disposal. At 6 months, 20% to 30% of apertures require further storage.

CONCLUSIONS: Brass apertures require additional storage after a course of PRT to allow decay to acceptable levels. This requires significant space and manpower and should be considered in the design process for new clinical facilities. More widespread adoption of pencil beam or spot scanning nozzles may obviate this issue, as apertures will no longer be necessary.

(P048) Target Volume Heterogeneity Index: A Potentially Valuable Metric in Prostate Cancer Treatment Planning

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PURPOSE/OBJECTIVES: Heterogeneity index (HI) has been described in the literature as a tool for evaluating dose gradients within a planning target volume (PTV). HI may be expressed as D1/D95, where D1 and D95 equal the dose encompassing 1% and 95% of the target volume, respectively. The purpose of this study is to evaluate the effect of target volume dose heterogeneity on dose received by local organs at risk in the treatment of low- and intermediate-risk prostate cancer.

MATERIALS AND METHODS: Treatment plans were reviewed for 157 patients with low- or intermediate-risk prostate cancer treated with dose-escalated radiation therapy from June 2007 to February 2012. Patients treated in the postoperative setting or receiving pelvic nodal irradiation were excluded. Patients were treated with either standard intensity-modulated radiation therapy (IMRT) using seven or eight fields or 2-arc volumetric modulated arc therapy (VMAT). All patients had daily image guidance. PTV HI (D1/D95) and dose-volume histogram (DVH) data at eight dose levels for rectum and bladder were recorded. Patients were categorized into two groups (low HI or high HI) with respect to median index score. A two-tailed t-test was used to test for differences in dose received by the rectum and bladder for the two groups. The data were then fit using a linear regression model to evaluate the predictive value of HI for dose received by the rectum and bladder.

RESULTS: For the 157 plans evaluated, the mean PTV volume was 164 cc and the mean prescription dose was 7,833 cGy. Median HI was 1.04 (range: 1.0–1.08). Low HI (≤1.04) was found to correlate with significantly lower rectal V50 (P = .02), V55 (P = .01), V60 (P = .01), V65 (P = .01), and V70 (P = .01). There was no significant correlation with dose received by the bladder. HI was similar for patients treated with standard IMRT and VMAT (P = .85).

CONCLUSIONS: Target volume HI ≤1.04 is associated with more favorable rectal doses at clinically relevant doses. We believe HI may serve as a valuable metric in prostate cancer treatment planning. Further work is needed to correlate these dosimetric findings with clinical outcomes.

(P049) Validation of a Novel Superior Vena Cava Syndrome Identification, Classification, and Management Algorithm

David A. Hampton, MD, MEng; Christina Gamboa, BS; John R. Zatarain, MD; Brian Diggs, PhD; Charles R. Thomas, MD; Oregon Health and Science University

INTRODUCTION: Superior vena cava (SVC) syndrome results from compromised venous return due to extrinsic compression of the great vessels, obstruction from an intramural thrombus, and/or secondary to an indwelling catheter. SVC can escalate into a life-threatening condition. The Yale classification system and management algorithm is based upon patient presentation and tumor characteristics and was devised as a starting point towards evidence-based multidisciplinary treatment and to allow comparison of results from different institutions. The Yale classification system does not address respiratory symptoms that may precede vascular compromise (facial, neck, or extremity edema), nor does it address nononcologic causes of SVC. We hypothesized that this classification system and management algorithm was limited in scope and may exclude clinical parameters, patient populations, and gender differences, which could lead to earlier identi-