Radiation Oncology

104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

RSNA® 2018
TOMORROW'S RADIOLOGY TODAY

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

RO100-ED-X

Radiologists in the Radiation Treatment Planning Room: How Increased Collaboration Between Prostate Imagers and Radiation Oncologists Fosters Best Practices in the Treatment of Prostate Cancer

All Day Room: NA Digital Education Exhibit

Awards
Identified for RadioGraphics

Participants
Clayton P. Smith, BA, Bethesda, MD (*Presenter*) Nothing to Disclose
Lindsay Rowe, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Anna M. Laucis, MD , Ann Arbor, MI (*Abstract Co-Author*) Spouse, Scientific Advisor, Biomarker.io; Spouse, Scientific Advisor, Stroke Code; Spouse, Scientific Advisor, Biomojo;
Avinash Chaurasia, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Marcin Czarniecki, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Stephanie A. Harmon, PhD , Bethesda, MD (*Abstract Co-Author*) Research funded, NCI
Sherif Mehralivand, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Peter L. Choyke, MD, Rockville, MD (*Abstract Co-Author*) Nothing to Disclose
Deborah Citrin, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Baris Turkbey, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

cps54@georgetown.edu

TEACHING POINTS

Imaging of prostate cancer is quickly evolving with the growing use of prostate mpMRI and novel imaging techniques like DCF-PyI PSMA-PET. Radiation oncologists rely on radiologists' interpretations of these imaging studies to make appropriate treatment decisions. To facilitate the best communication of image interpretation, our institution has a low threshold for consulting the radiology department to assist with many aspects of treatment decision making on behalf of the radiation oncology department. The purpose of this exhibit is to show how increased collaboration between Radiology and Radiation Oncology fosters the best environment for patient care. The examples given are for prostate cancer treatment, but these conclusions can be adapted to any cancer treatment discipline with numerous emerging imaging techniques.

TABLE OF CONTENTS/OUTLINE

Case presentations will exhibit how increased collaboration assisted with treatment making decisions. Collaboration between the radiology department and radiation oncology department are executed in the following settings: Active Surveillance MRI of the prostate for treatment planning MRI of the prostate in recurrent prostate cancer Novel Imaging techniques

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

RO101-ED-X

Radiation and the Central Nervous System: A Pictorial Essay from the Eyes of the Neuroradiologist

All Day Room: NA Digital Education Exhibit

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Adam W. Jaster, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Bhavya R. Shah, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Robert D. Timmerman, MD, Dallas, TX (*Abstract Co-Author*) Research Grant, Varian Medical Systems, Inc
Zabi Wardak, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Amit K. Agarwal, MD, MBBS, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Karuna M. Raj, MD, Dallas, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

karunam183@gmail.com

TEACHING POINTS

The goal of this presentation is to: 1. Provide an overview of the different types of radiation therapies (XRT) used in the central nervous system (CNS), including external beam, stereotactic radiosurgery (SRS), brachytherapy, proton beam, and craniospinal radiation. 2. Review common applications of each type of radiation therapy used to treat pathology of the CNS. 3. Review current concepts of treatment planning performed by radiation oncologists. 4. Highlight essential imaging findings relevant to treatment planning, post-procedural follow-up, and potential complications.

TABLE OF CONTENTS/OUTLINE

1. Introduction (development of XRT and use in the CNS). 2. Basic differences between and applications of each type of therapy (external beam, SRS, brachytherapy, proton beam, craniospinal radiation [e.g. whole brain]). 3. Radiation oncology treatment planning, including patient positioning, simulation, and treatment volumes, with review of dose thresholds for critical structures. 4. Pre-treatment imaging checklist/relevant information that the neuroradiologist should report for each type of therapy/application (i.e. what does the radiation oncologist want to know?). 5. Post-treatment follow-up imaging for each type of therapy/application (expected post-treatment findings, findings suggestive of disease progression, and potential treatment complications).

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

RO102-ED-X

Abscopal Effect: What Oncor Radiologists Should Know

All Day Room: NA Digital Education Exhibit

Awards
Identified for RadioGraphics

Participants
Barbara P. Matos, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Eduardo M. Araujo, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Douglas J. Racy, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Graziela C. Oliveira, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Monique B. Ordones, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Juliana R. Gomes, MD, Sao Jose do Rio Preto, Brazil (*Abstract Co-Author*) Nothing to Disclose
Ana C. Uski, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Luciana M. Piccolo, MD, Campo Grande, Brazil (*Abstract Co-Author*) Nothing to Disclose
Natalia B. Gomes, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

babipmatos@gmail.com

TEACHING POINTS

1. The abscopal effect consists of tumor regression at a distant site from the primary site of radiotherapy. These additional systemic immunogenic effects are being studied, yet not completely understood. 2. The immunogenic cell death process begins with the release of immunogenic factors, triggering the release of endogenous damage-associated molecular patterns. The utmost result is the improved antigen presentation to T cells. 3. A deeper understanding of the synergic mechanisms involved can boost the strategic use of those therapies.

TABLE OF CONTENTS/OUTLINE

1. Case based review of 18FDG PET/CT and MRI imaging following radiotherapy from 18 patients with metastatic melanoma and radiographic evidence of worsening disease, during the use of monoclonal antibodies such as Ipilimumab, Nivolumab or Pembrolizumab, evaluating the incidence of the abscopal effect. 2. Demonstrate the role of PET/CT in the oncologic follow-up, not only in finding early recurrence, but also in monitoring response to treatment and detecting the antitumor immune response stimulated by radiation-induced tumor cells death.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

RO103-ED-X

Prostatic Carcinoma Treated with Focal Brachytherapy: Multiparametric Magnetic Resonance Imaging Patterns

All Day Room: NA Digital Education Exhibit

Participants
Gianpiero Cardone, MD, Milano, Italy (*Presenter*) Nothing to Disclose
Andrea Losa, MD, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Paola Mangili, PhD, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Fraco Gaboardi, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

cardone.gianpiero@hsr.it

TEACHING POINTS

mpMR maging effectiveness in the early evaluation of post-implant dosimetry in patients treated with permanent FB.Spectrum of mpMR findings of prostate gland treated with permanent FB. Evolution, as time passed, of the signal intensities of prostate treated with permanent FB.

TABLE OF CONTENTS/OUTLINE

1) FB of the prostate: technical aspects2) mpMR imaging techniques 3) Anatomic and functional MR patterns of prostate gland after FB:a) size b) morphology c) contrast enhancement d) diffusione) spectroscopyf) periprostatic changes after treatment4) Post-implant dosimetry, performed on fused transverse T1w-T2w MR images, using dedicated image fusion software.Morphologic MR evaluation showed reduction in size of the treated area of the gland and diffuse reduction of signal intensity on T2w images due to parenchimal fibrosis and atrophy. Dynamic ce MR evaluation showed reduction of the vascularization of the treated area of the gland. DCE and Spectroscopy showed atrophy of treated areas and normal patterns on spared portion of the gland. Radiation therapy seeds were seen as small foci of focal signal intensity void. MR can be an effective imaging technique in the follow-up of prostate tumors treated with permanent FB, in the early evaluation of post-implant dosimetry and in patients with clinical or biochemical suspect of recurrence.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

RO104-ED-X

Role of C11-Choline and F18-Fluciclovine PET in Radiation Treatment Planning for Recurrent Prostate Cancer

All Day Room: NA Digital Education Exhibit

Participants
Ronik Bhangoo, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose
William W. Wong, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Ming Yang, MD, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

With the unique ability to conduct PET/CT and PET/MR scans in biochemically recurrent prostate cancer using both C11-Choline and F18-Fluciclovine tracers, we summarize our experience in radiation treatment plan decision making with the assistance of these advanced molecular imaging modalities. The purpose of this exhibit is: a) To review the definitions of biochemical recurrence in prostate cancer as well as treatment options for patients with gross disease identified on imaging. b) To introduce the radiopharmaceutical characteristics, indications and clinical applications of C11-Choline and F18-Fluciclovine PET tracers. c) To discuss the utility of C11-Choline and F18-Fluciclovine PET/CT and PET/MR images in radiation treatment planning for recurrent prostate cancer.

TABLE OF CONTENTS/OUTLINE

a) Recurrent prostate cancer: background, biochemical recurrence definition, treatment options. b) Comparison of C11-Choline and F18-Fluciclovine PET tracers: metabolic pathway, target, dosimetry and bio-distribution pattern. c) Case review (representing variety of clinical scenarios): imaging findings, treatment decision and radiation treatment planning. d) Future direction and summary.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

RO105-ED-X

Imaging in Radiation Treatment Planning and Follow Up to Assess Tumor Response of Gynecological Malignancies

All Day Room: NA Digital Education Exhibit

Participants
Raj M. Paspulati, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
Bryan J. Traughber, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Kevin R. Kalisz, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

Raj.Paspulati@UHhospitals.org

TEACHING POINTS

1. Understanding different methods of Radiation treatment in Gynecological Malignancies 2. Role of Imaging (MRI & PET-MRI) in initial staging and Follow up after Radiation Treatment 3.Comparison of conventional and MRI guided Brachytherapy treatment planning

TABLE OF CONTENTS/OUTLINE

1. Role of Radiation Treatment in Gynecological Malignancies 2. Review of different methods of Radiation Treatment 3. Technique of Brachytherapy Treatment planning and role of imaging with emphasis on Intra operative MRI 4. Imaging in initial staging and Follow up to assess tumor response after Radiation Treatment illustarted with cases examples 5. Utility of PET-MRI 6. Pit falls of convetional Brachytherapy treatment plannning with examples

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

SPOI11

Oncodiagnosis Panel: Oropharyngeal Cancer (Interactive Session)

Sunday, Nov. 25 10:45AM - 12:15PM Room: E451B

HN NR OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants

James S. Welsh, MD, Aurora, IL (*Moderator*) Nothing to Disclose
Christine M. Glastonbury, MBBS, San Francisco, CA (*Presenter*) Author with royalties, Reed Elsevier
Upendra Parvathaneni, MBBS,FRANZCR, Seattle, WA (*Presenter*) Nothing to Disclose
Michael K. Gibson, MD,PhD, Nashville, TN (*Presenter*) Advisory Board, Amgen Inc; Speaker, Bristol-Myers Squibb Company; ;
Pierre Lavertu, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

mike.gibson.1@vanderbilt.edu

christine.glastonbury@ucsf.edu

pierre.lavertu@uhhospital.org

LEARNING OBJECTIVES

1) To present the rationale for changes in oropharyngeal cancer staging in the AJCC/UICC 8th edition. 2) To reinforce the necessity of a team approach to cancer management and the utility of the radiologist for aiding staging. 3) Be able to understand the relative roles of surgery and radiotherapy in the management of oropharyngeal cancer. 4) Be able to understand the role of transoral surgery (TORS) in the management of early oropharyngeal lesions. 5) To review and understand the roles of chemotherapy and biological therapy as radiosensitizers in treatment of orophryngeal cancer.

SSA20

Physics (Ultrasound in Imaging and Radiation Therapy)

Sunday, Nov. 25 10:45AM - 12:15PM Room: S102CD

PH RO US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Flemming Forsberg, PhD, Philadelphia, PA (*Moderator*) Research Grant, Canon Medical Systems Corporation; Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Lantheus Medical Imaging, Inc
Thaddeus A. Wilson, PhD, Madison, WI (*Moderator*) Nothing to Disclose

Sub-Events

SSA20-01 Parametric Mapping of the Prostate with Contrast-Enhanced Subharmonic Imaging

Sunday, Nov. 25 10:45AM - 10:55AM Room: S102CD

Participants
Bradley Freid, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Ethan J. Halpern, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Venkat Masarapu, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Priscilla Machado, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Edouard J. Trabulsi, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, Intuitive Surgical, Inc Stockholder, Intuitive Surgical, Inc Consultant, Amgen Inc Speaker, Amgen Inc Consultant, Johnson & Johnson Speaker, Johnson & Johnson
Flemming Forsberg, PhD, Philadelphia, PA (*Presenter*) Research Grant, Canon Medical Systems Corporation; Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Lantheus Medical Imaging, Inc

For information about this presentation, contact:

flemming.forsberg@jefferson.edu

PURPOSE

To prospectively evaluate different quantitative parameters from contrast-enhanced transrectal subharmonic imaging (SHI) for the diagnosis of prostate cancer with histopathology as the reference standard.

METHOD AND MATERIALS

Fifty-five male patients scheduled for a transrectal systematic prostate biopsy were enrolled in this IRB-approved study. A 12-core sextant biopsy was done in each subject along with up to 6 additional targeted biopsies. Subjects were imaged with a transrectal IC5-9D ultrasound (US) transducer on a modified Logiq E9 system (GE Healthcare; Milwaukee, WI) operating in SHI mode (transmit/receive: 7.0/3.5 MHz). Two vials of the US contrast agent Definity (Lanteus Medical Imaging; N. Billerica, MA) diluted in 50 mL of saline were infused over 10 minutes. Images were obtained with transverse sweeps though the prostate using conventional US, color and power Doppler, as well as contrast harmonic imaging (HI), and SHI. Microbubble destruction pulses followed by motion-compensated maximum intensity projection (MIP) was evaluated in combination with HI and SHI. Imaging modes were rated on a five-point scale (1-5; benign to definitely malignant) for each sextant. Using MIP time intensity curves, parametric maps were generated at each biopsy location for the peak intensity (PI), time to peak (TTP), and estimated perfusion (EP as the slope of the wash-in). Parameters were compared to biopsy results.

RESULTS

Prostate cancer was found in 55 of 660 cores (8.33%) from 24 of the 55 subjects (43.64%). No significant difference between benign and malignant biopsy specimens were demonstrated for TTP (3.01 ± 1.52 vs 3.18 ± 1.56 s; p=0.44). Two quantitative SHI parameters showed a significant difference between benign and malignant biopsy cores: EP (25.69 ± 8.74 vs 30.09 ± 10.23 a.u./s; p=0.0007) and PI (123.85 ± 16.02 vs 129.66 ± 17.38 a.u.; p=0.014).

CONCLUSION

Quantitative SHI demonstrates significantly higher EP and PI at sites with prostate cancer.

CLINICAL RELEVANCE/APPLICATION

SHI appears to improve the diagnosis of prostate cancer relative to conventional transrectal US.

SSA20-02 Ultrasonic Spectrum Analysis of the RF Time Series Can Early Predict the Tumor Response to Chemotherapy in Preclinical Breast Cancer Models

Sunday, Nov. 25 10:55AM - 11:05AM Room: S102CD

Participants
Fei Li, MD, Guangzhou, China (*Presenter*) Nothing to Disclose

Yini Huang, MD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Jianhua Zhou, MD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Longhui Cao, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Jianwei Wang, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Chunyi Lin, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Qing Li, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Xueyi Zheng, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Yun Wang, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

lifei@sysucc.org.cn

PURPOSE

This study was aimed to assess whether ultrasonic spectrum analysis of radiofrequency (RF) time series using a clinical ultrasound system allows for the early prediction of the tumor response to chemotherapy in human breast cancer xenografts that imitate clinical responding and nonresponding tumors.

METHOD AND MATERIALS

Clinically responding (n=20; MCF-7) and nonresponding (n=20; MBA-MD-231) breast cancer xenografts were established in 40 nude mice. Ten mice from each group received either chemotherapy (adriamycin, 4 mg/kg) or saline as controls. Each tumor was imaged longitudinally with a clinical ultrasound scanner at baseline (day 0) and subsequently on days 2, 4, 6, 8 and 12 following treatment, and the corresponding RF time-series data were collected. Changes in six RF time-series parameters (slope, intercept, S1, S2, S3 and S4) were compared with the measurement of the tumor cell density, and their prediction performances of the treatment response were analyzed.

RESULTS

Adriamycin significantly inhibited tumor growth and decreased the cancer cell density in responders ($P < 0.001$) but not in nonresponders ($P > 0.05$). Fold changes of slope were significantly increased in responders two days after adriamycin treatment ($P = 0.002$), but not in nonresponders ($P > 0.05$). Early changes in slope on day 2 could predict the treatment response in 100% of both responders (95% CI, 62.9-100.0%) and nonresponders (95% CI, 88.4-100%).

CONCLUSION

Ultrasonic RF time series allowed for the monitoring of the tumor response to chemotherapy and could further serve as biomarkers for the early prediction of treatment outcomes.

CLINICAL RELEVANCE/APPLICATION

Because ultrasound imaging provided several major benefits such as the relatively low cost, portability and repeatability, and lack of radiation risks, our study built the foundation of further translational research to assess the clinical application of the RF time series to predict the treatment response in cancer patients without using any contrast agents.

SSA20-03 Electric-Field Induced Acoustic Tomography (EfAT) for In-Situ Monitoring of Tumor Ablation during Irreversible/Reversible Electroporation

Sunday, Nov. 25 11:05AM - 11:15AM Room: S102CD

Participants
Ali Zarafshani, Norman, OK (*Abstract Co-Author*) Nothing to Disclose
Siqi Wang, Norman, OK (*Abstract Co-Author*) Nothing to Disclose
Bin Zheng, PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Liangzhong Xiang, PhD, Norman, OK (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

a.zarafshani@ou.eduxianglzh@ou.edu

PURPOSE

High intensity ultra-short pulsed electric fields applied across a cell to increase the membrane permeability, allowing non-permeant drugs, genes access (or tumor ablation) through the formation of nano-scale pores in the cell membrane, known as reversible (or irreversible in the case where nano-scale defects in the cell membrane is used for tumor ablation instead of drugs/genes delivery). For physicians, real-time monitoring of cancer treatment and characterization of the delivered electric field is very important for treatment planning and therapy efficacy monitoring. Many techniques i.e. MRI or MREIT are suggested to characterize this process, but currently cannot monitor the process during pulse delivery in real time and mostly used for pre-and post-stimulation exposure.

METHOD AND MATERIALS

A new imaging technique based on flow of electric field induced acoustic tomography is reported. The absorbed electric energy around the subject under test raises its temperature, thus leading to expansion effects. The expansion, then induces acoustic tomography images which can be acquired outside the body and consequently be used for real-time characterization and monitoring the electroporation process. These acoustic images made through the high-intensity and ultra-short pulsed electric fields that used in the electroporation process where combines the advantages of high-contrast electric field distribution and high-ultrasonic spatial resolution.

RESULTS

We captured different acoustic signals and corresponding ultrasonic images by changing the location of electric distribution in scale of mm and varying the electric field intensity (μs-ns 20kVcm-1-63kVcm-1) applied in irreversible and reversible electroporation process. The experimental results demonstrated a linear correlation between the measured acoustic signals and the intensity of the electric field.

CONCLUSION

The study results indicate that this new technique can potentially be used for monitoring the electric field distribution as a non-invasive, label-free technique for real-time, in situ monitoring of electroporation-based technologies for treatment and ablation cancer.

CLINICAL RELEVANCE/APPLICATION

for ECT and NIIRE, the treatment efficiency is correlated to electric field distribution. To ensure adequate electric field coverage of the treated tumor EfAT to mapping the eletric field distribution is used for treatment plannning and therapy efficacy monitoring in the clinic.

SSA20-04 Accuracy of Volumetric Measurements in the Breast: A Study of Comparing Ultrasound Tomography and Hand-Held Ultrasound

Sunday, Nov. 25 11:15AM - 11:25AM Room: S102CD

Participants
Rajni Natesan, MD, MBA, Houston, TX (*Presenter*) Officer, QT Ultrasound Labs
Bilal Malik, PhD,MS, Novato, CA (*Abstract Co-Author*) Employee, QT Ultrasound Labs
Lauralyn R. Markle, MD, Laguna Niguel, CA (*Abstract Co-Author*) Consultant, QT Ultrasound Labs
Vashita Dhir, MD, Beverly Hills, CA (*Abstract Co-Author*) Consultant, QT Ultrsound, LLC
Robin Terry, Novato, CA (*Abstract Co-Author*) Employee, QT Ultrasound, LLC

PURPOSE

This study assessed the accuracy of volumetric measurements acquired with ultrasound tomography (UST). UST imaging generates 3D speed-of-sound maps that can identify tissue types and measure lesion volumes. Since tumor volume doubling time is associated with growth rate and tumor biology, accurate measurement of tumor volume is critical for oncologic diagnosis, staging, and treatment.

METHOD AND MATERIALS

Six cylindrical agar phantoms were imaged using UST and hand-held ultrasound (HHUS). Each phantom contained 4 embedded "lesions" composed of irregular-shaped chicken breast with known volumes ranging from 1.3 cm3 to 7.4 cm3. Two board-certified breast imaging fellowship-trained radiologists independently performed blind interpretations of the UST and HHUS phantom images and calculated 24 lesion volumes. UST volumes were calculated with automated segmentation software (QT Ultrasound, Novato, CA). HHUS lesions were measured in 3 dimensions (a, b, c) and their volumes were calculated using 2 volume formulas: (1) (4/3)πr3 (with r = average of a, b, and c); and (2) (π/6)abc. These calculations were then statistically analyzed to determine the volumetric measurement accuracy of both UST and HHUS as compared to known true volumes calculated by water displacement methods.

RESULTS

The average lesion volume calculated from UST images was 3.93 1.55 cm3 and from HHUS was 6.39 2.61 cm3 (sphere) or 5.65 2.39 cm3 (ellipsoid), compared to the true average of 3.98 1.47 cm3. HHUS volumes were significantly larger than the true volumes with a mean over-estimation of 62.8% 36.9% cm3 (sphere) or 43.3% 32.6% cm3 (ellipsoid), whereas UST volumes agreed with the truth within measurement errors. Interobserver agreement was substantial (ICC = 0.95).

CONCLUSION

This study demonstrates that UST can accurately measure the volume of irregular-shaped masses, with superior accuracy than HHUS.

CLINICAL RELEVANCE/APPLICATION

Ultrasound tomography can accurately measure tumor volume, demonstrating its potential utility in guiding oncologic management and treatment.

SSA20-05 Evaluating Ductal Carcinoma in situ Progression via Tissue Oxygenation and Perfusion Using Photoacoustic and Contrast-Enhanced US

Sunday, Nov. 25 11:25AM - 11:35AM Room: S102CD

Participants
Ryan Margolis, Philadelphia, PA (*Presenter*) Nothing to Disclose
John R. Eisenbrey, PhD, Philadelphia, PA (*Abstract Co-Author*) Support, General Electric Company Support, Lantheus Medical Imaging, Inc
Flemming Forsberg, PhD, Philadelphia, PA (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation; Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Lantheus Medical Imaging, Inc
Ji-Bin Liu, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Corinne Wessner, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Kibo Nam, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Maria Stanczak, MS, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

ryanamargolis@gmail.com

PURPOSE

To investigate tissue oxygenation and perfusion as predictors of the aggressiveness of ductal carcinoma in situ (DCIS) as well as the influence of physical exercise on these parameters as well.

METHOD AND MATERIALS

Twenty FVB/NJ and 10 Tg(C3-1-TAg)cJeg mice (Jackson, Laboratories, Bar Harbor, ME) were evenly split into active and control subgroups, where the active group had access to a Fisher Science exercise wheel. Changes in mammary gland vascularity and perfusion were monitored with a Vevo 2100 LAZR scanner (FujiFilm VisualSonics, Toronto, Canada) using a LZ-250 PA probe.

Photoacoustic imaging was used to measure tissue oxygenation. To assess perfusion quantification, each mouse received a retroorbital bolus injection of 10 µL of 3-4 µm sized microbubbles (Advanced Microbubble Laboratories, Boulder, CO). Imaging of the mammary gland was performed weekly over 6 weeks and the mice were weighed biweekly. Offline analysis was performed using Vevo CQ software.

RESULTS

For the FVB/NJ mice, weekly weight changes were lower for the active group than the control group (0.43±0.70 g vs. 0.99±2.31 g, p = 0.002). Conversely, changes in oxygenation were higher for the active group than the control group (11.16±19.30% vs. 7.77±26.73; p=0.38). There were no statistical differences for contrast wash-in rates (a measure of perfusion), or area under the curve between the two groups (p>0.25). For the SV40 Tag mice that naturally develop breast tumors, the weight changes were lower for the active group than control group (1.71±1.34 g vs. 2.57±1.51 g, p=0.0056). There was also a statistical significant decrease in oxygenation in the exercise group compared to the control group (-19.37±26.88% vs. 20.21±29.55%; p<0.001). Similarly, there were no statistical differences between the wash-in rate or area under the curve between the two groups (p>0.26).

CONCLUSION

Preliminary results indicate differences in tissue oxygenation between the FVB/NJ and SV40 Tag mice may become a predictive precursor for DCIS progression. The influence of exercise was shown by the weight changes, but the influence on DCIS progression is still being investigated.

CLINICAL RELEVANCE/APPLICATION

This study may potentially minimize breast cancer overtreatments by predicting the aggressiveness of DCIS in humans via tissue oxygenation measurements using ultrasound.

SSA20-06 A New Microfluidic Setup to Adjust Objectively 2D and 4D DCE-US Presets as an Alternative to Preclinical Studies

Sunday, Nov. 25 11:35AM - 11:45AM Room: S102CD

Participants
Virginie Grand-Perret, MSc, Villejuif, France (*Presenter*) Nothing to Disclose
Ning Yao, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Ingrid Leguerney, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Baya Benatsou, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Philippe De-Vomocourt, DPhil, Ile-de-France, France (*Abstract Co-Author*) Nothing to Disclose
Nathalie B. Lassau, MD, PhD, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Stephanie Pitre-Champagnat, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

virginie.grand-perret@u-psud.fr

PURPOSE

Ultrasound tumor microvascularization assessment is a promising biomarker of patient response to anti-angiogenic drugs. Quantitative DCE-US imaging lacks dedicated phantoms featuring small vessels in order to optimize the image acquisition and define the preset parameters objectively. We propose a microfluidic setup dedicated to methodological development, and we compare it to a preclinical study on mice.

METHOD AND MATERIALS

Microfluidic setup The phantom was a 2.5x5x1cm3 block featuring cylindrical channels of diameters ranging from 145 to 450 µm. Sonovue (Bracco) was driven through the channels with very high reliability by a MFCS-EZ microfluidic flow controller (Fluigent SA, France). Flow rate was measured in real-time by a dedicated platform. An Aplio500 ultrasound scanner (Toshiba Medical Systems, Japan) with 2D and 4D 12MHz probes was used to acquire Contrast Harmonic Imaging (CHI) raw data. Quantification was made using UltraExtend FX software (Toshiba). The main parameters studied were mechanical index (MI), frequency (F), frame rate (fps), 4D volume angle (vol). *Preclinical study* 5 mice were imaged using the same 2D and 4D 12 MHz probes and injected with 100 µL Sonovue. 180 seconds raw data clips centered on the kidney were acquired and quantified using the scanner software. The same parameters were studied as on the microfluidic setup.

RESULTS

Microfluidic setup A new generation of microflow phantom enabled the precise control of 60-120 µL/min flow rates by a microfluidic pressure controller with a stable flow and under 5% variation over 3 minutes. After confirming the lack of microbubble destruction by the flow controller, the effects of MI, F, fps and vol were individually quantified. The best setup for optimal signal over noise ratio was MI 0.18, F h8.0 MHz, 4 fps, vol 30°. *Preclinical study* The best setup parameters were confirmed on the acquisitions on mice, however the in vivo variability of perfusion quantification was higher.

CONCLUSION

The microfluidic setup we developed can be used to perform reproducible tests and set up acquisition parameters objectively in DCE-US imaging modes. It is an alternative approach to preclinical studies, and is more objective than in vivo models.

CLINICAL RELEVANCE/APPLICATION

The new microfluidic setup was relevant to set up DCE-US imaging mode parameters in an objective way and to adjusting the presets in DCE-US 2D and 4D.

SSA20-07 Simultaneous MR and Ultrasound Image Acquisition in a Human Using a Hands-Free, MR-compatible, Volumetric Ultrasound Transducer for Image Guided Radiation Therapy

Sunday, Nov. 25 11:45AM - 11:55AM Room: S102CD

Participants
Bryan Bednarz, PhD, Madison, WI (*Presenter*) Nothing to Disclose
Warren Lee, Niskayuna, NY (*Abstract Co-Author*) Nothing to Disclose
David M. Mills, PhD, Niskayuna, NY (*Abstract Co-Author*) Nothing to Disclose
David Shoudy, Niskayuna, NY (*Abstract Co-Author*) Nothing to Disclose
Heather Chan, Niskayuna, NY (*Abstract Co-Author*) Nothing to Disclose
Aqsa Patel, Niskayuna, NY (*Abstract Co-Author*) Nothing to Disclose
James Sabatini, Niskayuna, NY (*Abstract Co-Author*) Nothing to Disclose
Eric Fiveland, MS, Niskayuna, NY (*Abstract Co-Author*) Nothing to Disclose
Bo Wang, Niskayuna, NY (*Abstract Co-Author*) Nothing to Disclose
Jihmli Mitra, Niskayuna, NY (*Abstract Co-Author*) Nothing to Disclose
Shourya Sarcar, Niskayuna, NY (*Abstract Co-Author*) Nothing to Disclose
Tim Fiorillo, Niskayuna, NY (*Abstract Co-Author*) Employee, General Electric Company
Kwok Pong Chan, Niskayuna, NY (*Abstract Co-Author*) Employee, General Electric Company
Alan B. McMillan, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
James H. Holmes, PhD, Madison, WI (*Abstract Co-Author*) Institutional research agreement, General Electric Company Spouse, Employee, Standard Imaging, Inc
Wesley Culberson, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Charles Matrosic, MS, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Michael F. Bassetti, MD, Madison, WI (*Abstract Co-Author*) Research Grant, Merck KGaA; Research Grant, AstraZeneca PLC;
Andrew Shepard, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Sydney Jupitz, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Patrick Hill, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
James A. Zagzebski, PhD, Madison, WI (*Abstract Co-Author*) Consultant, Gammex Sunnuclear; ; ; ;
Scott Smith, Niskayuna, NY (*Abstract Co-Author*) Nothing to Disclose
Thomas K. Foo, PhD, Niskayuna, NY (*Abstract Co-Author*) Employee, General Electric Company

For information about this presentation, contact:

bbednarz2@wisc.edu

CONCLUSION

These first human images demonstrate that the hands-free, electronically steerable e4D transducer can acquire ultrasound images during a MR acquisition without impacting either the MR or ultrasound images quality. This technology may be applied to other image-guided procedures (e.g. proton therapy, biopsies, and drug delivery).

Background

This work addresses the need for a cost-effective and non-invasive real-time motion management platform for radiotherapy. We have developed the first ever hands-free, MR-compatible, electronically-steered, and real-time volumetric (e4D) ultrasound probe that will be used to directly track tumor or vessel motion during radiation therapy. The ultrasound images acquired during treatment will be coupled to a pre-treatment training image set consisting of a simultaneous 4D ultrasound and 4D MRI acquisition. The images will be rapidly matched using advanced signal processing algorithms, allowing for the display and verification of MR-based tumor/organ motion in real-time from an ultrasound acquisition.

Evaluation

The transducer contains 18,000 piezoelectric elements and beam forming and data acquisition electronics in the transducer housing. Currently, the probe is designed to have a maximum imaging depth of 15 cm, with 2 mm lateral resolution at 7 cm. The transducer acquires a 3D electronically-steered volume (4 vps) with a maximum sweep angle of 30o. Simultaneous MR and ultrasound images were acquired on a healthy volunteers liver using a GE 3T MR750 scanner. A fast spoiled gradient echo (FSPGR) multi-phase 2D sagittal acquisition with temporal acquisition of 4 fps was used for imaging. A 32-channel cardiac phased-array receiver coil was used with the transducer positioned under anterior elements. Ultrasound images were acquired in harmonic mode (1.7/3.3 MHz) at a rate of 4 fps using the transducer and a GE Vivid E95 system. Images were co-analyzed using MIM Maestro.

Discussion

No significant artifacts were detected during the acquisition of the MR and ultrasound images. Some low level susceptibility artifacts near the transducer in the MR image was detected, but this was well-contained within 1-2 cm of the surface and did not adversely effect the image quality.

SSA20-08 Optimization of a Subharmonic Dynamic Contrast-Enhanced Ultrasound Technique for Liver Tumor Imaging

Sunday, Nov. 25 11:55AM - 12:05PM Room: S102CD

Participants
Jacinta Browne, PhD, Dublin 8, Ireland (*Presenter*) Nothing to Disclose
Aoife Ivory, Dublin, Ireland (*Abstract Co-Author*) Nothing to Disclose
Andrew Fagan, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

jacinta.browne@dit.ie

PURPOSE

Conventional dynamic contrast-enhanced ultrasound (DCE-US) detects the first harmonic signal component arising mainly from the contrast agent (CA) microbubbles perfusing through the tissue, although the tissue itself also generates harmonics. Subharmonic

(SH) signal detection holds significant potential for increasing the sensitivity of tumor detection in the liver as only the CA generates subharmonics. This paper describes the optimization of the SH-DCE-US technique via bench-level experiments and its translation to a clinical scanner.

METHOD AND MATERIALS

Experiments were performed to maximize the signal from a commercial CA (SonoVue®, Bracco, Switzerland; default and an altered bubble size distribution) using a home-built microbubble characterization system with variable control over transmit beam center frequency and number of cycles. The optimal transmit beam parameters were translated to a commercial scanner (Aixplorer, Supersonic Imagine, France). A novel perfusion phantom, comprising different compartments mimicking healthy, diseased and necrotic tissue regions, was developed and used to validate the new technique on the scanner.

RESULTS

The maximum SH signal was measured for a transmit beam of 3 cycles centered at 1.9 MHz (i.e. SH signal at 0.95 MHz) for the native CA (57% bubble volume 4-10μm). The optimal transmit frequency increased to a more useful range of 2.3-2.5 MHz (SH signal at 1.15-1.25 MHz) in an altered CA with reduced polydispersity ((1-4μm; 99%/82% bubble count/volume, respectively). DCE time-intensity curves were produced on the clinical scanner using these optimal transmit beam parameters with the perfusion phantom, with improved quantification at depth of the microbubble signal using the new SH technique.

CONCLUSION

Optimal transmit beam parameters have been established for maximizing the SH signal in DCE-US scanning of the liver. Furthermore, a simple alteration of the CA's polydispersity shifted the optimal SH detection frequency above 1 MHz, which is the typical lower-frequency limit for curvilinear probes used for liver scanning. Improvements were demonstrated using a novel perfusion phanton.

CLINICAL RELEVANCE/APPLICATION

This paper demonstrates an optimized dynamic contrast-enhanced liver ultrasound imaging technique, using subharmonic signal detection with an easily-altered microbubble contrast agent formulation.

SSA20-09 US-Triggered Antibiotic Release from Novel Spinal Fusion Hardware

Sunday, Nov. 25 12:05PM - 12:15PM Room: S102CD

Participants
Lauren J. Jablonowski, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Cemile Basgul, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Daniel W. MacDonald, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Noreen J. Hickok, PhD, Philadelphia, PA (*Abstract Co-Author*) Researcher, Zimmer Biomet Holdings, Inc, Inc; Researcher, Synergy Technologies, Inc; Research collaboration, Acuitive Technologies, Inc
Steven M. Kurtz, PhD, Philadelphia, PA (*Abstract Co-Author*) Exponent; Active Implants Corporation; B. Braun Melsungen AG; Celanese; Ceramtec; Johnson & Johnson; DJO GLobal, Inc; Ferring Group; Formae; Kyocera Medical ; Medtronic plc ; Simplify Medical; Smith & Nephew plc; Stelkast; Stryker Corporation ; Wright Medical Technology, Inc; Zimmer Biomet Holdings, Inc; Invibio; Reed Elsevier
Flemming Forsberg, PhD, Philadelphia, PA (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation; Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Lantheus Medical Imaging, Inc

For information about this presentation, contact:

lauren.jablonowski@jefferson.edu

PURPOSE

To determine optimal acoustic parameters for destruction of a polymeric membrane surrounding a prophylactic-containing spinal reservoir. The long-term goal is to achieve ultrasound (US)-triggered release of antibiotics from within this spinal spacer to prevent post-surgical infection.

METHOD AND MATERIALS

Polylactic acid (PLA)-coated, methylene blue (MeB)-loaded polyether ether ketone (PEEK) spacers (0.785cm3) with a drug-loading reservoir were created in our labs. Coated spacers were submerged in water and insonated for 10 minutes using a Logiq E9 scanner (GE Healthcare, Waukesha, WI) with a C1-6 curvilinear probe, using power Doppler to rupture the PLA coating for MeB release. Frequencies evaluated were 1.7, 2.5, and 3.6 MHz, pulse repetition frequencies (PRFs) tested were 0.1, 3.5, and 6.4 kHz, and acoustic output (AO) powers tested were 30, 60, and 100%. MeB release was evaluated qualitatively against known MeB concentration standards immediately following insonation and again after 24 hours. Results were collected in triplicate and compared with a one-way ANOVA.

RESULTS

Membrane rupture increases with lower frequencies, but no significant difference was observed in release from the spacers at the frequencies evaluated (70-100% cumulative release, p=0.48). Therefore, 1.7 MHz was selected as optimal. This frequency was maintained, while PRF was varied. A PRF of 0.1 kHz resulted in significantly less immediate release (17.5±1.3%; p=0.021), but no difference was seen between PRFs of 3.5 kHz (32.5±2.5%) and 6.4kHz (36.3±5.4%, p>0.99). AO power was varied with 1.7 MHz and PRF 6.4 kHz. There was no significant difference in release between the AO powers (p>0.08). Uninsonated controls exhibited only 1.3±1.2% immediate release (p=0.031), and 6.8±2.8% cumulative release (p=0.021), confirming US-triggered release as opposed to passive leakage.

CONCLUSION

This study determined scanning parameters appropriate for US-triggered release of encapsulated prophylactics, as a first step towards deployment of this drug delivery system.

CLINICAL RELEVANCE/APPLICATION

This system will aggressively combat post-surgical bacterial infection with great versatility in applications for wide clinical impact.

SSA22

Physics (Image Processing in Imaging and Radiation Therapy)

Sunday, Nov. 25 10:45AM - 12:15PM Room: S103CD

PH RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

Maryellen L. Giger, PhD, Chicago, IL (*Moderator*) Stockholder, Hologic, Inc; Shareholder, Quantitative Insights, Inc; Shareholder, QView Medical, Inc; Co-founder, Quantitative Insights, Inc; Royalties, Hologic, Inc; Royalties, General Electric Company; Royalties, MEDIAN Technologies; Royalties, Riverain Technologies, LLC; Royalties, Mitsubishi Corporation; Royalties, Canon Medical Systems Corporation
Robert Jeraj, PHD, Madison, WI (*Moderator*) Founder, AIQ Services
Baowei Fei, PhD, Cleveland, OH (*Moderator*) Nothing to Disclose

Sub-Events

SSA22-01 CNN-based Image Super-Resolution for CT Slice Thickness Reduction using Paired CT Scans for Improving Robustness of Computer-aided Nodule Detection System

Sunday, Nov. 25 10:45AM - 10:55AM Room: S103CD

Participants
Kyu-Hwan Jung, PhD, Seoul, Korea, Republic Of (*Presenter*) Stockholder, VUNO Inc
Woong Bae, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seungho Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Gwangbeen Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyunho Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, VUNO Inc
Sang Min Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

khwan.jung@vuno.co

PURPOSE

To evaluate the effectiveness of a slice thickness reduction technique in computed tomography(CT) scans using convolutional neural network(CNN)-based super-resolution(SR) network for improving the sensitivity of lung nodule detection in thick section CT scans.

METHOD AND MATERIALS

We collected 100 sets of CT scans with identical acquisition protocols that were differentiated only by the slice thickness (1mm, 3mm, and 5mm). By employing CNN-based SR network, we trained the model to learn the residuals between synthesized thin section slices and real thin section slices. We used 80 sets of CT scans for training, 5 sets for the validation and the remaining 10 sets were used for quantitative evaluation. We separately collected 100 sets of CT scans (also with 1mm, 3mm, and 5mm slice thickness) with one biopsy-confirmed nodule per scan(46 solid nodules and 54 non-solid nodules, size ranges 6-12mm) to evaluate the effectiveness of the slice thickness reduction techniques for improving the lung nodule detection performance in thick section CT scans. The computer-aided detection(CAD) system used for the evaluation of lung nodule detection performance was internally developed with LUNA16 dataset, which contains 888 CT scans with slice thickness less than 3mm.

RESULTS

When slice thickness was reduced from 3mm to 1mm, the peak signal-to-noise ratio(PSNR) and structural similarity index(SSIM) were 30.9624 and 0.8142 respectively; when slice thickness was reduced from 5mm to 1mm PSNR and SSIM were 29.2620 and 0.7439 respectively. In the nodule detection task, all solid and non-solid nodules were detected by the CAD system using 1mm slice thickness scans(100.0% recall). However, 2 solid nodules were missed when using 3mm slice thickness scans (95.7% recall) while their corresponding synthetic 1mm scans improved the recall to 97.8% (1 missed solid nodule). Recall of scans with 5mm slice thickness was 89.1% and 85.2% while their synthetic 1mm scans improved the recall to 100.0% and 96.3% for solid and non-solid nodules respectively.

CONCLUSION

Our CNN-based SR method generates synthetic thin section slices from thick section slices which improve lung nodule detection performance using CAD.

CLINICAL RELEVANCE/APPLICATION

Robustness to acquisition protocol is essential for reliable lung CAD systems. Our slice thickness reduction technique may improve the robustness of CAD systems when applied to CT scans with various slice thickness.

SSA22-02 An Image Enhancement System for Disease Diagnosis

Sunday, Nov. 25 10:55AM - 11:05AM Room: S103CD

Participants
Timothy Perk, Madison, WI (*Presenter*) Nothing to Disclose
Robert Jeraj, PHD, Madison, WI (*Abstract Co-Author*) Founder, AIQ Services

For information about this presentation, contact:

perk@wisc.edu

PURPOSE

Varying background intensity levels in medical images increases the difficulty of reading images and of identifying abnormal image regions. Windowing and leveling techniques are performed on the entire image, which fails to account for regional differences in image intensity. A method which normalizes image regions by expected image intensity in that particular region could improve diagnostic accuracy of scans.

METHOD AND MATERIALS

This technique is demonstrated for 18F-NaF PET/CT scans of 37 metastatic prostate cancer patients with a total of 1,751 bone lesions. Each image was divided into 19 skeletal regions, such as the humeri, ribs, or ilium, and thresholds were determined for each region. For this work, statistically optimized regional thresholding (SORT) determined thresholds by performing ROC optimization to determine detection thresholds in each bone region that maximize combined sensitivity and specificity for the detection of bone lesions. Finally, image voxels in each region were normalized by dividing the intensity values by the corresponding regional threshold. The detection rate and visibility of lesions was compared between the SORT normalized image and the image windowed at the lesion detection threshold recommended in literature (SUV=10 g/mL).

RESULTS

SORT windowed images, which used 18 different normalization values (SUV range: 3-13 g/mL), improve detection of lesions with higher sensitivity (96% for SORT, 83% for SUV=10 g/mL) while retaining high specificity (97% for SORT, 97% for SUV=10 g/mL). Regional normalization images increased the visibility of lesions by reducing the number of adjustments to windowing required and setting background across the image to values lower than 1.

CONCLUSION

Region-specific windowing of medical images can not only make an image easier for radiologists to read, but also assist in the identification of abnormal image regions, effectively reducing the amount of time required to read medical images. Regional windowing in this work was performed using thresholds optimized for disease detection; however, thresholds could be derived from other techniques, such as population mean healthy uptake in a region.

CLINICAL RELEVANCE/APPLICATION

Unlike traditional windowing or leveling, region-specific windowing can account for regional differences across an image, thus reducing the amount of time and effort required to read medical images.

SSA22-03 Evaluation of an Automated Deformable Mapping Technique with and Without External Fiducial Markers to Relate Corresponding Lesions in Digital Breast Tomosynthesis and Automated Breast Ultrasound Images

Sunday, Nov. 25 11:05AM - 11:15AM Room: S103CD

Participants
Crystal Green, MENG, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Mitchell M. Goodsitt, PhD, Ann Arbor, MI (*Abstract Co-Author*) Investigator, General Electric Company; Research collaboration, General Electric Company
Jasmine H. Lau, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Kristy K. Brock, PhD, Houston, TX (*Abstract Co-Author*) License agreement, RaySearch Laboratories AB
Cynthia Davis, Niskayuna, NY (*Abstract Co-Author*) Nothing to Disclose
Paul L. Carson, PhD, Ann Arbor, MI (*Abstract Co-Author*) Research collaboration, General Electric Company Research collaboration, Light Age, Inc

For information about this presentation, contact:

canngree@umich.edu

PURPOSE

To test an automated deformable mapping method for registering corresponding lesions in digital breast tomosynthesis (DBT) and automated breast ultrasound (ABUS) images with and without the use of external fiducial markers.

METHOD AND MATERIALS

A CIRS multi-modality breast phantom containing 20 lesions was employed and imaged with DBT (upright positioning with craniocaudal (CC) compression and mediolateral oblique (MLO) compression), and ABUS (supine positioning with anterior-to-chest wall compression). Eight external fiducial markers (gel pads containing 1-mm glass beads) were attached to the surface of the breast phantom prior to the imaging. The reconstructed images were segmented using manual (ABUS) and semi-automated (DBT) techniques. An automated mapping method generates, deforms, and relates the resulting models of the breast for registration of lesions between the DBT (CC or MLO) and ABUS image sets. Performance was assessed by the number of matched paired lesions and measures of the distances between the centers of mass (dCOM) of corresponding lesions.

RESULTS

The maximum number of lesions that could be matched was 18 because 2 of the 20 lesions were too close to the chest wall to be visible in the reconstructed DBT images. For mapping of DBT-CC to ABUS without markers, 14 of the 18 lesions were matched and the mean dCOM was 13.64 ± 6.25 mm. With markers, 17 of the 18 lesions were matched and the mean dCOM was 12.83 ± 6.03

mm. For mapping of DBT-MLO to ABUS without markers, 8 of the 18 lesions were matched and the mean dCOM was 9.32 ± 2.82 mm. With markers, 17 of the 18 lesions were matched and the mean dCOM was 12.25 ± 5.75 mm.

CONCLUSION

This work demonstrates the potential for using this deformable mapping technique to identify related lesions between two DBT views and ABUS images. This method shows improved lesion correlation with the use of external fiducial markers. This should improve radiologists' characterization of breast lesions which should reduce patient callbacks and unnecessary biopsies. Future work will include an IRB-approved proof of concept study with patient data for registration between DBT and ABUS images.

CLINICAL RELEVANCE/APPLICATION

This works demonstrates the use of an automated deformable registration technique between two DBT views and ABUS images and shows potential in improving the characterization of breast lesions between these modalities.

SSA22-04 Medical Image Fusion Using M-Band Wavelet Transform for Radiotherapy

Sunday, Nov. 25 11:15AM - 11:25AM Room: S103CD

Participants
Satishkumar Chavan, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose
Abhijit D. Pawar, MD, Pune, India (*Abstract Co-Author*) Nothing to Disclose
Sanjay Talbar, Nanded, India (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

abhijitpawar.rad@gmail.com

CONCLUSION

The fused images using proposed method provides the best out of both CT and MRI. The proposed fusion scheme has potential application in precise localization and delineation of lesions in treatment planning of radiotherapy.

Background

Radiation oncologists need information from both the Computed Tomography (CT)and Magnetic Resonance Imaging (MRI) sequences for precise outlining of tumour in radiotherapy. The proposed work aims to create new enriched image using medical image fusion of CT and MRI slices. The spectral features from source slices are extracted using M-band Wavelet Transform (MBWT).MBWT is separable, orthogonal transform with a perfect reconstruction property. It provides high directional sensitivity and finer spectral resolution. The average for low frequency subbands and maxima for high frequency subbands are used as fusion rules. The inverse transform reconstructs visually enriched fused image.This fused image is an excellent assistance to the radiation oncologist for delineation of tumour to prepare precise treatment plan.

Evaluation

In this work, total 39 sets of CT and MRI slices are used. The qualitative evaluation of the work is done in context with visual perception, contrast enhancement, confidence to lesion delineation and usefulness in treatment planning. Three expert radiologists rated fused images on the scale of 0 (poor) to 4 (excellent).The quantitative evaluation involves fusion metrics viz.entropy (En), image quality index (IQI), edge quality index (EQI), and mean structural similarity index measure (mSSIM) which are useful for quality, similarities with source images, and edge preservation.

Discussion

The fused images using proposed method provide better retention of the anatomical structures and visualization of lesions as compared to the state of art wavelet techniques as presented in Figure 1. The average score by three radiologists for fused images using presented work is 3.87.In quantitative evaluation, the fusion parameters are calculated and they give highest values for all the fused images using proposed method which indicate that proposed technique outperforms over other fusion techniques.

SSA22-05 Using Texture Analysis to Optimize Reconstruction Parameters

Sunday, Nov. 25 11:25AM - 11:35AM Room: S103CD

Participants
Kenneth Nichols, PhD, New Hyde Park, NY (*Presenter*) Royalties, Syntermed, Inc;
Christopher Caravella, New Hyde Park, NY (*Abstract Co-Author*) Nothing to Disclose
Christopher J. Palestro, MD, New Hyde Park, NY (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

knichols@northwell.edu

PURPOSE

In providing SPECT phantom quality assurance images to accrediting agencies, it is not obvious whether it is preferable to submit reconstructions performed using typical clinical (CLIN) protocol processing parameters, or to follow agencies' filtered backprojection (FBP) suggestions. We applied texture analysis metrics to determine the degree to which these choices affect equipment capability assessment.

METHOD AND MATERIALS

Phantom data were processed for 128 SPECT scans acquired for 32 Mcts for 10 gamma cameras, using 666-814 MBq 99mTc in cylindrical water baths with Plexiglas inserts of 6 sphere & rod sizes. Reconstructions were performed following agencies' suggestions of FBP & Hanning filtering (cutoff = 1.0) & Chang attenuation correction. Algorithms written in IDL v8.4 computed texture analysis gray-level-co-occurrence matrix (GLCM) entropy, with sphere contrast computed by fitting radial count profiles to 3rd order polynomial curves. ROC analysis established optimal discrimination thresholds using as the reference standard dichotomous visual readings of a medical imaging physicist, who graded sphere & rod visibility without knowledge of texture analysis values. The same phantom was used to collect 13 additional data sets with a dual detector SPECT camera equipped with a 4-slice non-

diagnostic CT scanner, reconstructed by FBP & by the manufacturer's default settings for clinical bone SPECT/CT protocols by OSEM (10 subsets; 2 iterations) & Butterworth filtering (cutoff = 0.5, order = 5), incorporating attenuation correction using the CT scan. GLCM computations were compared for FBP & CLIN reconstructions.

RESULTS

Optimal criteria for best agreement with visual scores for spheres was contrast (81±1% accuracy), & for rods was entropy (97±1% accuracy). For the 13 new acquisitions, by there criteria, more rods would have been visible for FBP than CLIN (46% versus 39%, p = 0.02), & more spheres (57% versus 40%, p = 0.0003), with greater sphere contrast (28±21% versus 19±18%, p < 0.0001). Rod entropy & sphere entropy were significantly different for FBP & CLIN reconstructions (-13.5±3.1K versus -14.6±2.8K, p < 0.0001 & -3.1±1.4K versus -4.6±3.9K, p = 0.0001), & favored detecting rods & spheres by FBP over CLIN.

CONCLUSION

Texture analysis can help in obtaining optimal results for equipment test data.

CLINICAL RELEVANCE/APPLICATION

Texture analysis provides a useful basis for choosing among image reconstruction options.

SSA22-06 Real-Time Deformable Image Registration for MRI-Guided Radiotherapy

Sunday, Nov. 25 11:35AM - 11:45AM Room: S103CD

Participants
Gregory C. Sharp, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Seyedali Mirzapourrezaei, Wichita, KS (*Abstract Co-Author*) Nothing to Disclose
Thomas Mazur, St Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Nagarajan Kandasamy, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
James Shackleford, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Ehsan Salari, Wichita, KS (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

gcsharp@partners.org

CONCLUSION

Real-time deformable image registration is a viable strategy for tracking organs in MR-guided radiotherapy. It is a promising approach for next-generation applications including beam tracking and real-time plan optimization.

Background

MR-guided radiotherapy has the capability to acquire 2D cine-mode images of patient cross sections in near real time. These images are used for monitoring of patient position and motion management using respiratory gating. Beam tracking is a radiotherapy strategy where the therapy beam continuously follows the target position based on real-time sensing. To enable beam tracking, the position of the intended target and avoidance structures must be identified in real-time. This abstract investigates real-time deformable image registration as an approach for MR-guided radiotherapy.

Evaluation

Registration accuracy and speed were retrospectively evaluated on sagittal plane cine-mode video sequences from nine stomach cancer patients. The video resolution was 100 x 100 pixels, with a pixel spacing of 3.5 mm. Images were registered to a reference image at the beginning of the sequence. Accuracy was evaluated by comparing manually drawn contours of the stomach with a warped reference contour. A total of 90 images, 10 from each patient, were annotated and analyzed. Speed was measured for the registration only, with file I/O excluded. B-spline registration was performed using plastimatch, with GPU-accelerated sum of squared difference cost function, and multicore-accelerated curvature regularization. To assess real-time performance, computation time was limited to 200 milliseconds.

Discussion

B-spline image registration ran at 8.8 +/- 2.0 milliseconds per iteration, which allowed 22 iterations to be performed. Registration accuracy was estimated to be 2.2 +/- 1.1 mm, using the center of mass of the manually drawn contours as the standard. Dice coefficient of the stomach was found to be 0.90 +/- 0.03. Approximately 90 percent of the computation time was used to compute regularization, we estimate that implementing this routine on the GPU will allow 100 iterations to be performed within 200 milliseconds.

SSA22-07 MR T2 * Parameter Imaging Based on DANTE Black Blood Prepared Sequence and Modified JSENSE Reconstruction Method

Sunday, Nov. 25 11:45AM - 11:55AM Room: S103CD

Participants
Yanan Ren, Zhengzhou, China (*Presenter*) Nothing to Disclose
Jingliang Cheng, MD,PhD, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

1554847793@qq.com

CONCLUSION

Multi-contrast images can be jointly recontructed by modified Jsense method with effective removal of the residual aliasing artfact at a high acceleration factor. Accurate T2* maps are obtained by DANTE-GRE due to its high SNR and effective blood signal supression.Phantom experiments demonstrated that the incorporation of modified Jsense and DANTE-GRE may outperform conventional multi-echo GRE T2* mapping.

Background

Quantitative analysis of T2* value is an effective tool to reflect iron content of human tissue in MRI, which are closely related to Mediterranean anemia.A new MRI pulse sequence and a modified reconstruction method were proposed to improve accuracy of T2* measurement. Specifically, DANTE prepared sequence is selected to supress blood signals and modified reconstruction method based on JSENSE is proposed to improve image quality and reduce scan time.

Evaluation

A numerical bloch simulations were established on DANTE prepared sequence to prove the velocity sensitivity and to select parameters.Several phantom experiments completed by DANTE-GRE realized more accurate T2* quantification with blood suppression compared with multi-echo GRE and MSDE-GRE sequence.The PSNR and HFEN were chosen to assess the quality of coil sensitivities and multi-contrast images recontructed by SENSE,Jsense and modified Jsense algorithm with acceleration factors of 2, 3 and 4. At last,ROIs in T2* maps obtained both in phantom and vivo were evaluted between DANTE-GRE sequence and modified Jsense method with former convential methods.

Discussion

The phantom results validate the superiority of modified Jsense algorithm in increaseing smoothness of multi-channel coil sensitivities and decreasing artifacts of multi-contrast images at a high acceleration factor.However,images of the first echo recovered by modified JSENSE achieve lower HEEN and higher PSNR compared to the last echo which has lower SNR due to its intrinsic T2* decay. By combining modified Jsense algorithm with DANTE-GRE sequence which could further acquire more image information and better image quanlity, more accurate T2* maps could acquire since the artifacts originating from flowing blood are effectively supressed.

SSA22-08 Automatic Cardiac Ventricle Segmentation from CT Images Using Fully Convolutional Neural Networks

Sunday, Nov. 25 11:55AM - 12:05PM Room: S103CD

Participants
Ryan Chamberlain, PhD, Minneapolis, MN (*Presenter*) Employee, ImBio, LLC
Lauren Keith, Minneapolis, MN (*Abstract Co-Author*) Employee, ImBio, LLC; Stock options, ImBio, LLC;
German Gonzalez, PhD, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Acute pulmonary embolism (PE) is an emergent condition with three month mortality rate of 15%. Presence of PE is most often confirmed using Computed Tomography Pulmonary Angiography (CTPA). Mortality from PE is usually caused by overload of the right ventricle. The quantification of the right ventricular to left ventricular diameter ratio has been proved to be a quantitative prognostic marker for staging acute PE. Despite strong evidence for RV/LV as a prognostic marker in PE it is not always reported because it suffers from high interobserver variability and manual effort to measure. This work investigates automating the first step in an automated RV/LV CAD tool: ventricle segmentation.

METHOD AND MATERIALS

Fifty CTPA scans were used for this study (20 from cad-pe.org and 30 from a closed dataset). The ground truth segmentations were created by an imaging expert. This work developed a convolutional neural network (CNN) capable of segmenting the left and right cardiac ventricles from a 2D CT slice. The CNN was based on the U-Net. The training data consisted of 43 cases, the validation data consisted of 2 cases, and the test data consisted of 5 cases. The network was trained on 2D slices. To test the performance the CNN was passed all slices from a series and the largest morphologically connected region for each output class (RV and LV) was kept as the final segmentation. The CNN was trained with the original data and with an augmented data set where each slice passed to the network during training underwent a series of perturbations consisting of: 1) flipping, 2) noise injection, 3) deformation, and 4) random erasing.

RESULTS

The CNN trained on the original dataset has an average Dice coefficient of 0.96 on the training data and 0.90 on the testing data. The CNN trained with data augmentation had an average Dice coefficient of 0.94 on the training data and 0.94 on the testing data.

CONCLUSION

The CNN was able to create quality ventricle segmentations with only 43 scans in the training dataset, and the set of data augmentations significantly improved the performance on the test dataset.

CLINICAL RELEVANCE/APPLICATION

Accurate reporting of RV/LV can improve the diagnosis and staging of acute PE, but it is currently underreported because of interobserver variability and high manual effort. Automating this calculation could increase the rate and quality of RV/LV reporting, thereby improving patient care in emergency departments.

SSA22-09 Multi-institutional Deep Network for High Performance Sorting of Over 3000 AP and PA Chest Radiographs

Sunday, Nov. 25 12:05PM - 12:15PM Room: S103CD

Participants
Thomas J. Rhines, Chicago, IL (*Presenter*) Nothing to Disclose
Jennie S. Crosby, BS, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Feng Li, MD, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Heber MacMahon, MD, Chicago, IL (*Abstract Co-Author*) Consultant, Riverain Technologies, LLC Stockholder, Hologic, Inc Royalties, UCTech Research support, Koninklijke Philips NV Consultant, General Electric Company
Maryellen L. Giger, PhD, Chicago, IL (*Abstract Co-Author*) Stockholder, Hologic, Inc; Shareholder, Quantitative Insights, Inc; Shareholder, QView Medical, Inc; Co-founder, Quantitative Insights, Inc; Royalties, Hologic, Inc; Royalties, General Electric Company; Royalties, MEDIAN Technologies; Royalties, Riverain Technologies, LLC; Royalties, Mitsubishi Corporation; Royalties, Canon Medical Systems Corporation

For information about this presentation, contact:

tjrhines@uchicago.edu

PURPOSE

The classification of chest radiographs as anteroposterior (AP) or posteroanterior (PA) is important for their interpretation and any subsequent analysis and diagnosis. DICOM header information is often incomplete, and 328 of the 2364 (14%) chest radiographs acquired at our institution lacked the required information for AP/PA classification.

METHOD AND MATERIALS

Using a chest radiograph dataset from our institution, a convolutional neural network with AlexNet architecture was trained from scratch. 1475 AP and 713 PA radiographs were used, with 65% for training, 20% for step-wise validation, and 15% for testing. After training was complete, the network was tested on an independent set of 500 AP and 500 PA images from the National Institutes of Health chest radiograph dataset.

RESULTS

The independent test set yielded an AUC of 0.97 ± 0.0046, with less than 9% (89 of 1000) of radiographs misclassified. Of the images misclassified, several were improperly oriented or included a number of radiopaque medical devices. Our institutional dataset was used for training because of its high image quality and the lack of image imprinted "AP" or "PA" labels. Many images in the NIH dataset contain imprinted AP/PA labels, prompting their exclusion from the training dataset to avoid training the network to simply look for the imprinted label for the classification.

CONCLUSION

This model shows multi-institutional generalization of a trained network for the task of classifying AP and PA radiographs. A primary application of this network is for automated classification of the AP/PA view within the clinical workflow. The high AUC achieved demonstrates that the classification can be performed with high accuracy. Training the model took 4.5 minutes and testing 10,000 images took 130 seconds. Due to its speed, the classification technique could be applied without disruption of clinical workflow.

CLINICAL RELEVANCE/APPLICATION

To ensure appropriate classification and correct labeling of an image as AP or PA, a trained convolutional neural network can be used clinically with high accuracy and efficiency.

SSA23

Radiation Oncology (Radiobiology/Science)

Sunday, Nov. 25 10:45AM - 12:15PM Room: E353A

OI PH RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Martin Colman, MD, Houston, TX (*Moderator*) Stockholder, Steward Health Care
Meng X. Welliver, MD, Columbus, OH (*Moderator*) Nothing to Disclose

Sub-Events

SSA23-01 Brain Radiation-Induced Fatigue is Associated with Neuroinflammation and Suppression of Orexin Signaling

Sunday, Nov. 25 10:45AM - 10:55AM Room: E353A

Participants
Aaron J. Grossberg, MD, PhD, Portland, OR (*Presenter*) Nothing to Disclose
Die Zhang, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Wei Zhou, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Connie C. Weng, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Phillip S. Gross, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Elisabeth G. Vichaya, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Robert Dantzer, DVM,PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
David R. Grosshans, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

grossber@ohsu.edu

PURPOSE

Fatigue, the most common acute and subacute toxicity of partial or whole brain radiation therapy (WBRT), significantly decreases quality of life for patients, abrogating the benefit afforded by improved tumor control. The objective of the study is to evaluate the roles of neuroinflammation and orexin neuron activity in the pathogenesis of fatigue induced by clinically relevant WBRT fractionation.

METHOD AND MATERIALS

Adult male Sprague-Dawley rats received WBRT, 4 Gy in 5 daily fractions, or sham irradiation. Home cage locomotor activity (LMA) was continuously monitored using a photobeam system. Food intake and body weight were collected weekly. Cerebrospinal fluid (CSF) and brain sections were collected at fatigue onset, peak, and recovery. CSF orexin concentration was measured using radioimmunoassay. RNA was isolated from homogenized brain sections and inflammatory and oxidative expression patterns were evaluated using quantitative PCR. The data were compared to physician-reported fatigue, and orexin and cytokine CSF protein levels collected pre- and post-radiation from a cohort of 11 pediatric patients receiving proton radiation for primary brain cancer. Data were analyzed by t-test or 2-way ANOVA with post hoc Bonferroni corrected t-test. Significance was set at $P<.05$.

RESULTS

LMA was decreased in WBRT-treated rats starting following the first fraction and continued to decrease until reaching a nadir following the 5th and final fraction. LMA slowly recovered after that point, returning to baseline. Food intake and weight gain were significantly reduced in WBRT-treated rats, recovering to match sham rats within 2 weeks of the first fraction. The onset of fatigue is associated with widespread neuroinflammatory gene expression and decreased CSF orexin levels, which resolves as fatigue improves. Orexin levels were decreased and cytokine levels increased in CSF samples from patients for whom fatigue was recorded as a toxicity during treatment.

CONCLUSION

Brain radiation-induced fatigue is associated with neuroinflammation and decreased orexin levels in both preclinical and clinical samples. These data provide potential therapeutic avenues to address this disabling and pervasive toxicity of brain radiation.

CLINICAL RELEVANCE/APPLICATION

Neuroinflammation and orexin signaling appear to underlie brain radiation-induced fatigue, providing potential therapeutic targets.

SSA23-02 Translocation Frequency in Patients with Repeated CT Exposure: Comparison with CT-Naive Patients

Sunday, Nov. 25 10:55AM - 11:05AM Room: E353A

Participants

Min Hoan Moon, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jin Kyung Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Myoung Seok Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyunsik Woo, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sohee Oh, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

mmhoan@gmail.com

PURPOSE

To compare translocation frequency between patients with repeated computed tomography (CT) exposure and CT-naïve patients and to assess the relationship between radiation exposure and translocation frequency.

METHOD AND MATERIALS

This study was approved by our institutional review board. 48 cases with repeated CT exposure and 48 age- and sex-matched CT-naïve controls were prospectively enrolled in this single-institution study. Absorbed dose using dose-length product was used as a metric for radiation exposure and translocation frequency was assessed by using chromosome-specific fluorescent hybridization probes. The comparison of translocation frequency between cases and CT-naïve controls was performed by using Wilcoxon test (paired samples) and the relationship between radiation exposure and translocation frequency was assessed by partial correlation coefficient.

RESULTS

A statistically significant difference was present in translocation frequency between cases and CT-naïve controls (P = .0003). The median translocation frequency was 7 (95% confidence interval: 6, 8) for cases and 4 (95% confidence interval: 3, 6) for controls. By using translocation frequency as the response variable and radiation exposure (accumulated, maximum, and mean) as the effect variables, statistically significant correlation was found between accumulated radiation exposure and translocation frequency (r = .4279, P = .0030).

CONCLUSION

Chromosomal translocation was more common in patients with repeated CT exposure than CT-naïve patients, and a positive association was noted between accumulated radiation exposure and translocation frequency.

CLINICAL RELEVANCE/APPLICATION

Our results added evidence favoring a non-threshold response for radiation-associated cancer induction at low-level radiation exposure in medical practice.

SSA23-03 DNA Damage in Peripheral Blood Lymphocytes Induced By Low-Dose Chest CT: Comparison with Standard Dose Chest CT

Sunday, Nov. 25 11:05AM - 11:15AM Room: E353A

Participants
Hiroaki Sakane, MD, Hiroshima, Japan (*Presenter*) Nothing to Disclose
Chiemi Sakai, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Mari Ishida, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Wataru Fukumoto, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Satoshi Tashiro, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuo Awai, MD, Hiroshima, Japan (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation; Research Grant, Hitachi, Ltd; Research Grant, Fujitsu Limited; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Medical Advisory Board, General Electric Company; ;

PURPOSE

The purpose of this study was to evaluate the DNA damage in peripheral blood lymphocytes induced by a low-dose chest CT scan using γ-H2AX foci as a DNA damage maker.

METHOD AND MATERIALS

We obtained institutional review board approval and the written informed consent from 217 patients, who were prospectively enrolled in this study. A total of 146 patients underwent low-dose chest CT (120 kV, 50 mAs, pitch factor 1.39), and 71 patients underwent standard-dose chest CT (120 kV, AEC, pitch factor 0.813). Blood samples were obtained before and after CT scan. Lymphocytes were isolated and stained against γ-H2AX (phosphorylated histone variant H2AX). The number of γ-H2AX foci in at least 4,000 lymphocytes was analyzed automatically with fluorescence microscopy. Significant differences between the number of foci were tested by using paired t-test, Wilcoxon test.

RESULTS

There were no significant difference in the character of patients between low and standard dose chest CT groups. The mean dose length product was 132 mGy·cm in low-dose CT and 455 mGy·cm in standard-dose CT groups, respectively. There was no significant difference in the baseline level of γ-H2AX foci between low and standard dose groups before CT examination.The numbers of γ-H2AX foci of patients in low-dose CT group before and after CT scan were 0.90 (standard deviation: 0.50) and 0.93 (0.51), respectively. There was no significant difference in the number of γ-H2AX foci before and after low-dose CT. The numbers of γ-H2AX foci in standard-dose CT group increased from 1.00 (0.45) to 1.07 (0.48) after CT scan. In contrast to the low dose group, the number of γ-H2AX foci in the standard dose group showed significant increase after CT (p=0.025).

CONCLUSION

Radiation effect by a low-dose chest CT was too low to be detected by γ-H2AX assay.

CLINICAL RELEVANCE/APPLICATION

γ-H2AX assay may be useful to determine the optimal radiation dose for low-dose CT in lung cancer screening

γ-H2AX assay may be useful to determine the optimal radiation dose for low-dose CT in lung cancer screening.

SSA23-04 A Novel Molecularly Targeted Radiotherapeutic Agent (MTRT) to Deliver Immunomodulatory Radiation to Multiple Pediatric and Adult Solid Tumors

Sunday, Nov. 25 11:15AM - 11:25AM Room: E353A

Participants
Ravi Patel, MD,PhD, Madison, WI (*Presenter*) Nothing to Disclose
Reinier Hernandez, MSc, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Ryan Brown, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Joseph Grudzinski, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Peter Carlson, BS, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Eduardo Aluicio-Sarduy, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Jonathan Engle, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Bryan Bednarz, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Paul Sondel, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Jamey P. Weichert, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Zachary S. Morris, MD, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

rpatel55@wisc.edu

PURPOSE

Radiation therapy (RT) has been shown in preclinical studies to enhance the efficacy of several types of immunotherapies. However, traditional external beam radiation therapy (EBRT) is typically only delivered to a few sites of disease, with larger field sizes being associated with systemic lymphopenia. Because many patients have widespread disease, it is nearly impossible for them to benefit from the efficacy enhancements afforded by immunotherapies using standard RT. Conversely, our RT delivery approach using a novel, tumor-selective form of molecularly targeted radiation therapy (MTRT), Y90-NM600, may augment tumor specific immune-priming by delivering RT to multiple sites of disease.

METHOD AND MATERIALS

Syngeneic mice were inoculated with tumors from adult and pediatric solid tumor lines B78 (melanoma), LLC (lung), MOC1 (Head and Neck), 4T1 (breast), Panc02 (Pancreas), GL261 (high grade glioma), K7M2 (Rhabdomyosarcoma), NXS2 and 9464D (neuroblastoma). Mice were injected with 250 µCi of Y86-NM600 and scanned via PET/CT at 2, 24, 48, and 72 h. Organs were then harvested for bio-distribution (BioD) via gamma scintigraphy. Another cohort of mice with bi-lateral B78 flank tumors were treated with 12 Gy EBRT to a primary tumor and anti-CTLA4 and were randomized to be treated w/wo 50 µCi MTRT. Tumor growth and survival was monitored. All mice with complete response (CR) were re-challenged with B78.

RESULTS

PET/CT and BioD data showed preferential uptake of NM600 in all tumor lines with highest uptake in Panc02 pancreatic tumors (10-fold increase of uptake in tumor compared to bone marrow, 2-fold increase compared to spleen). In our therapeutic 2-tumor trial, addition of MTRT resulted in decreased tumor growth ($p < 0.05$) of both primary and secondary tumors when combined with immune checkpoint inhibitor and EBRT (primary tumor) compared to a matched cohort randomized to just EBRT (primary tumor) and anti-CTLA4 alone. 50% of mice in the MTRT arm had a complete response and memory to B78 re-challenge compared to 0% in the no MTRT (EBRT + anti-CTLA4 alone) arm.

CONCLUSION

NM600 is a novel form of MTRT that shows preferential uptake in multiple solid tumors and can deliver immunomodulatory RT to distant tumors to increase response rates to T cell checkpoint blockade.

CLINICAL RELEVANCE/APPLICATION

MTRT sensitizes metastatic cancer cells to immunotherapy and improves response rates to systemic immune checkpoint blockade therapy.

SSA23-05 Identifying the Effect of Hereditary Factors on Radiation-Induced Cardiac Toxicity Using Novel Genetic Rat Models

Sunday, Nov. 25 11:25AM - 11:35AM Room: E353A

Participants
Aronne M. Schottstaedt, MS, Cleveland Heights, OH (*Presenter*) Nothing to Disclose
Carmen R. Bergom, MD, PhD, Okauchee, WI (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

ams530@case.edu

PURPOSE

Radiation therapy is used in most cancer patients, but dose is limited by damage to normal tissue. The use of defined genetic models to assess radiation toxicity, followed by genetic mapping of radiosensitivity phenotypes, will allow for maximization of tumor dose while limiting normal tissue toxicity. In this study, we utilize consomic rats, which are genetically identical except that one chromosome is inherited from a second inbred rat strain.

METHOD AND MATERIALS

Adult male and female Salt Sensitive (SS) rats and SS.BN3 consomic rats, (SS background with Brown Norway chromosome 3), received image-guided localized whole heart radiation at a dose of 24 Gy or 9 Gy x 5 fractions. Echocardiograms with strain analysis were performed at baseline, 3, and 5 months. The student's t-test was used to compare values. RNA-seq from left ventricle samples at 1 and 10 weeks post radiation was performed and analyzed with IPA software.

RESULTS

Our previous studies have demonstrated that the SS.BN3 tumors are more radiosensitive than SS tumors. In the 24 Gy study, cardiac toxicity increased in SS compared to SS.BN3 male and female rats. End diastolic volume (EDV), a measure of ventricular dilation, was elevated after radiation in SS rats (EDV: 0.62 vs 0.49 ml, $p<0.01$). Systolic function measured with ejection fraction (EF), and contractility measured with radial strain, were lower in SS rats at 5 months (EF: 81 vs 94%, $p<0.01$, radial strain: 33 vs 68%, $p<0.01$). Left ventricular mass was elevated at 3 months in SS rats ($p<0.001$), and moderate-to-large pericardial effusions were present in 6/6 SS rats compared to 1/7 SS.BN3 rats at 5 months. Similar results are seen with the 9 Gy x 5 fractions. Gene expression analysis comparing SS and SS.BN3 females showed inflammatory and mitochondrial pathways with greatly altered expression, most notably at 1 week post-radiation.

CONCLUSION

These data show that SS rats are more sensitive to cardiac radiation than SS.BN3 rats, demonstrating the role of heritable factors in determining cardiac radiosensitivity. Gene expression analysis identified a number of cardiac-related targets on chromosome 3 for future studies of radiation protection. Further genetic mapping will aid in narrowing the causative target(s) for potential therapies.

CLINICAL RELEVANCE/APPLICATION

This project has the potential to enhance the effectiveness and toxicity profile of radiation therapy in cancer and to delineate new therapeutic targets.

SSA23-06 Role of Radio-Immunotherapy in the Treatment of Local and Distant Tumors in Prostate Cancer

Sunday, Nov. 25 11:35AM - 11:45AM Room: E353A

Participants
Sayeda Yasmin-Karim, Boston, MA (*Presenter*) Nothing to Disclose
Wilfred Ngwa, PHD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michele Moreau, Lowell, MA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

sayeda_yasmin-karim@DFCI.Harvard.edu

CONCLUSION

These results suggest that the use of SRB for sustained in-situ delivery of CD40 antibody could significantly enhance the abscopal effect of radiotherapy in treating prostate adenocarcinoma.

Background

Metastasis is the cause of death in most cancers including prostate. It has been observed by Mole and others that radiotherapy at one site may lead to regression of metastatic cancer at other sites, which were not irradiated; this phenomenon is called 'abscopal' effect. Unfortunately, this regression is not predictable. Some studies have observed an enhancement by systemic application of immunoadjuvants, which also has limited application because of generalized adverse effect. The purpose of this study is to evaluate the enhancing the abscopal effect of radiotherapy (RT) by in-situ delivered anti-CD40 using Smart Radiation Biomaterials (SRB) in the treatment of prostate cancer where treatment in one site (location) able to cure the tumors in other locations of the body.

Evaluation

A syngeneic mouse model of prostate adenocarcinoma was generated in both flanks of C57/BL6 background mouse. The palpable sized tumor of right flank was treated as randomized cohorts: control, treatment with 5 Gy of RT, anti CD40 antibody (20 µg/tumor), and in combination. Another cohort was created by sustained delivery of anti CD40 antibody using SRB where SRB material by itself demonstrates some degree of antineoplastic activity in our previous studies. A Small Animal Radiation and Research platform (SARRP) was used for image-guided RT at 220 kVp. Our result shows that in-situ application of antiCD40 antibody with radiation significantly enhances the effect of radiotherapy ($p<0.01$), whereas using the SRB for AntiCD40 delivery in situ further enhances the survival ($p<0.001$). Reduction of tumor volume was observed in both sides. 2 out of 5 mice showed total regression of the untreated tumors in the RT+SRB delivered AntiCD40 group.

Discussion

These promising findings provide a good basis for further/ongoing studies investigating RT and CD40 antibody dosing and scheduling and use of SRB for sustained in-situ delivery of such immunoadjuvants to further optimize the treatment outcomes with minimal systemic toxicities.

SSA23-07 Imaging and Treatment of Primary and Metastasized Tumors Through Immunotherapy Using Targeted Antigen-Capturing Nanoparticles with Serum Amyloid A1 along with Radiation and PD-L1 Blockade

Sunday, Nov. 25 11:45AM - 11:55AM Room: E353A

Participants
Satoshi G. Harada, MD, Morioka, Japan (*Presenter*) Nothing to Disclose
Takashi Segawa, Morioka, Japan (*Abstract Co-Author*) Nothing to Disclose
Takahiro Satoh, DSc, Takasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Shigeru Ehara, MD, Morioka, Japan (*Abstract Co-Author*) Nothing to Disclose
Koichiro Sera, Takizawa, Japan (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

sharada@iwate-med.ac.jp

PURPOSE

We aimed to image and treat primary and metastasized tumors in vivo using microcapsules that release antigen-capturing nanoparticles (AC-NPs) with serum amyloid A1 (SAA1) in three radiation sessions under PD-L1 blockade.

METHOD AND MATERIALS

For session 1, liposome-protamine-hyaluronic acid nanoparticles (LPH-NPs) containing 5% iopamiron and 400 μg anti-PD-L1 Ab were mixed with 1 mL 4.0% alginate, 3.0% hyaluronate, and 1 μg/mL P-selectin solution and incubated with 0.5 mM FeCl2 with 1 μg/mL a4ß1 Ab. Microcapsules were injected intravenously (IV) into BALB/c mice with primary LM17 tumors in the left hind leg and lung metastases. After 9 h, primary tumors were exposed to 10 or 20 Gy 60Co γ-rays. For session 2, AC-NPs generated by nanoprecipitation of 4 mg/ml polylactic-co-glycolic acid (PLGA) and 1000 ng/ml SAA1 were mixed with the cocktail described above and sprayed into 0.5 mM FeCl2 and 1 μg/mL anti-P-selectin Ab. Microcapsules (1 × 1010) were injected IV. After 9 h, tumors were irradiated as before. For session 3, 4 cGy 60Co whole-body γ-rays were administered at 24 h intervals for 5 d.

RESULTS

In session 1, anti-a4ß1 microcapsules accumulated around primary and metastatic tumors and were detected by CT. Microcapsules released P-selectin and anti-PD-L1 Ab in response to the initial irradiation. In session 2, microcapsules accumulated around the primary tumor via a P-selectin Ag-Ab reaction. PLGA AC-NPs and SAA1 were released after the second radiation dose. PLGA AC-NPs captured tumor-derived protein antigens released by the second radiation dose and transported them to SAA1-recruited and activated dendritic cells (DCs) that drove cross-priming of CD8+ T cells. In session 3, primed antitumor CD8+ T cells were activated by whole body radiation. These treatments significantly increased the antitumor effect (EF 1.7) and reduced metastasis by 74.3%.

CONCLUSION

Our CT-detectable microcapsules exhibited targeted AC-NP-mediated immunotherapeutic and abscopal effects, which could be used to advance tumor diagnoses and treatments.

CLINICAL RELEVANCE/APPLICATION

Targeted AC-NP-mediated immunotherapy with SAA1 directed by radiation enhanced the primary and metastatic antitumor effects of radiotherapy under PD-L1 blockade.

SSA23-08 Evaluation in Predicting Radiotherapy Efficacy for Esophageal Carcinoma Using Magnetic Resonance Diffusion-Weighted Imaging

Sunday, Nov. 25 11:55AM - 12:05PM Room: E353A

Participants
Andu Zhang, Shijiazhuang, China (*Presenter*) Nothing to Disclose
Yanfei Wang, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Gaofeng Shi, MD, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Qinglei Shi, Beijing, China (*Abstract Co-Author*) Employee, Siemens AG
Chun Han, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Hui Liu, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Li Yang, MD, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Ning Zhang, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Ruxun Li, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Tongxin Xu, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

zhangandu860520@163.com

PURPOSE

To evaluate magnetic resonance diffusion-weighted imaging (MR-DWI) technique in predicting the efficacy of radiotherapy for esophageal cancer

METHOD AND MATERIALS

Two related tests were performed in this experimental study. Test 1 included 40 Eca-109 nude mice models with esophageal cancer xenogrfts (test group=24; control group=16), and Test 2 included 42 and 42 mice models in test and control groups, respectively. The test group was given a single dose of 15Gy (6MV X-rays) during radiation therapy. In Test 1, sixteen time points included at 1 day before and 1 day after radiotherapy and then very two days during radiotherapy until 29th day. In the time points, all mice models underwent MRI scan with T1WI, T2WI, and DWI. In Test 2, MRI scans were performed at seven time points until 29th day and pathology results were obtained immediately after scans. The tumor volume and ADC value were evaluated in Test 1 and ADC values were compared with pathological cell density and necrosis in Test 2

RESULTS

Test 1, the growth doubling time was 17 days in test group and 5 days in control group. ADC values in test group rapidly increased at the 3rd day (highest at the 7th day) and then gradually decreased and returned to pre-therapy levels from the 17th day. In control group, the ADC values gradually decreased from the first day and kept at a low level from the 9th day. In Test 2, tumor cell density decreased from the 3rd day in test group compared with a gradual increased (highest at the 5th day) and then decreased in control group. Cell density in test group was lower than that in control group from the 3rd day after radiotherapy ($P<0.05$). ADC values were negatively correlated with cell density ($rs=-0.703$, $p=0.000$). The radio of necrosis of tumor in test group was higher than that in control group after the 3rd day ($P<0.05$). ADC values were positively correlated with the tumor necrosis ($rs=0.658$, $p=0.003$).

CONCLUSION

MR-DWI values could change earlier than morphological size during radiotherapy for esophageal cancer and ADC values showed good correlations with pathology findings, which has the potential in predicting the efficacy of radiation or other therapy.

CLINICAL RELEVANCE/APPLICATION

provide theoretical basis for the rational application of this technique in clinical practice

SSA23-09 Pseudoprogression versus Progression: The Role of Diffusion MRI During Immunotherapy for Solid

Tumor

Sunday, Nov. 25 12:05PM - 12:15PM Room: E353A

Participants
Alessandra Coppola, MD, Cava Detirreni, Italy (*Presenter*) Nothing to Disclose
Chiara Marigliano, MD, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Giulia Platania, MD, Gravina Di Catania, Italy (*Abstract Co-Author*) Nothing to Disclose
Daniel Volterra, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesca Travaglini, MD, Novara, Italy (*Abstract Co-Author*) Nothing to Disclose
Angelo Vanzulli, MD, Segrate, Italy (*Abstract Co-Author*) Travel support, Bracco Group

For information about this presentation, contact:

alessandracoppola@hotmail.it

PURPOSE

The aim of our study is to evaluate the role of diffusion-weighted MR sequences in the study of patients undergoing immunotherapy for stage IV solid tumors. The study aims to identify patients with pseudoprogression by calculating ADC and to differentiate them precociously from patients with true progression.

METHOD AND MATERIALS

Between September 2017 and March 2018 were evaluated with MRI with diffusion-weighted sequences (b value up to 800) 8 patients treated with immunotherapy (4 with renal cell carcinoma, 2 with pulmonary adenocarcinoma and 2 with melanoma). 11 target abdominal lesions were considered, positioning a ROI for the calculation of ADC in MRI performed at the beginning of therapy (RMt0), at the second infusion cycle (RMt1) and concomitantly with the revaluation TC, at approximately 8- 9 weeks (RMt2) after the start of treatment. Patients were staged at t0 and re-staged at t2 with toraco-abdominale and head contrast enhanced CT (TCt1 and TCt2) and were therefore classified as: progression (PD), partial response (PR), stable disease (SD) or pseudoprogression (PP) according to immuno-RECIST criteria.

RESULTS

Among the 8 patients evaluated, 2 died during immunotherapy (PD). Of the 6 patients on therapy, based on the immuno-RECIST criteria, 1 was considered PD, 1 PR, 3 were SD and 1 was definied in pseudoprogression (PP). The pseudoprogression is represented by a dimensional increase of the target lesion at t2. The ADC values calculated in the three MRI exams performed during immunotherapy are not significantly changed (mean ADC RMt0 0.71 ± 0.14, ADC RMt1 0.91 ± 0.39, ADC RMt2 0.76 ± 0.16).

CONCLUSION

Immunotherapy in solid tumors causes a transient increase in intratumoral lymphocyte infiltrate changing cell density in the lesion. The target lesions evaluated after the start of immunotherapy showed changes both in size and ADC value. The main limitation of our study is represented by the small number of patients currently evaluated.

CLINICAL RELEVANCE/APPLICATION

Despite an increase in size of target lesions in solid tumors (pseudo progression) ADC values calculated in MRI during immunotherapy are not significantly changed.

ROS-SUA

Radiation Oncology Sunday Poster Discussions

Sunday, Nov. 25 12:30PM - 1:00PM Room: RO Community, Learning Center

PH RO MI OI

AMA PRA Category 1 Credit ™: .50

Participants
Meng X. Welliver, MD, Columbus, OH (*Moderator*) Nothing to Disclose

Sub-Events

RO201-SD-SUA2 Atypical Response Patterns in Patients Treated with Nivolumab

Station #2

Awards
Student Travel Stipend Award

Participants
Richard Thomas, MBBS, MD, Boston, MA (*Presenter*) Nothing to Disclose
Bhanusupriya Somarouthu, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Francesco Alessandrino, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Vikram Kurra, MD, Cambridge, MA (*Abstract Co-Author*) Nothing to Disclose
Atul B. Shinagare, MD, Boston, MA (*Abstract Co-Author*) Advisory Board, Arog Pharmaceuticals, Inc; Research Grant, GTx, Inc

PURPOSE

To assess the frequency of various patterns of response and incidence of atypical response patterns in patients treated with anti-programmed death (PD) 1 antibody Nivolumab, across different cancer types and treatment regimens

METHOD AND MATERIALS

This IRB-approved, HIPAA-compliant retrospective study included 254 patients treated with Nivolumab alone or in combination, identified by review of electronic radiology database, from January 2013 through August 2017. The cancer type, start and end dates of treatment and the therapeutic agents were noted. The tumor response was prospectively assessed starting with the baseline scan, using RECIST1.1 (total 5 target lesions, up to 2 per organ). The median treatment duration was 5.2 months (IQR 2.7-12.8). A total of 166 patients (65%) showing clinical benefit to treatment (defined as stable disease, partial response or complete response) were identified. Among these, four patterns of response were noted: Pattern 1 - patients with decrease or <20% increase in sum of longest diameters (SLD) without any atypical changes, Pattern 2 - patients with 10-19% increase in SLD with subsequent return below baseline, Pattern 3 - patients with >=20% increase in SLD with subsequent return below baseline (pseudoprogression), and Pattern 4 - development of new lesions with decrease in SLD lasting through at least two consecutive scans. Patterns 2, 3 and 4 were defined as atypical response patterns.

RESULTS

Of 166 patients with clinical benefit, 33 (20%) showed atypical response patterns - 15 (9%) with Pattern 2, 2 (1%) with pattern 3 and 16 (10%) with Pattern 4. The frequency of atypical response patterns was highest in patients treated with Nivolumab and Ipilimumab combination (25/91, 27%) followed by Nivolumab alone (6/46, 13%) and least with Nivolumab and another chemotherapeutic agent (2/29, 7%); p=0.02. The frequency of atypical response was highest among patients with melanoma (14/45, 31%) followed by non-small cell lung carcinoma (7/29, 24%) and genitourinary carcinomas (7/30, 23%)

CONCLUSION

One in five patients treated with Nivolumab demonstrate atypical response patterns. It is important for the radiologists to be aware of these confusing response patterns to avoid errors in response assessment

CLINICAL RELEVANCE/APPLICATION

Radiologists must be aware of the atypical response patterns that can be seen in patients on immunotherapy, to avoid making an erroneous diagnosis of progressive disease

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Atul B. Shinagare, MD - 2017 Honored Educator

RO106-ED-SUA3 Response Assessment in Neuro-Oncology (RANO) Criteria for Gliomas: Practical Topics Using Conventional and Advanced Imaging Techniques

Station #3

Awards
Identified for RadioGraphics

Participants
Diego J. Oliveira, MD, Uberlandia, Brazil (*Presenter*) Nothing to Disclose
Ana Patricia F. Vieira SR, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Luis F. Godoy, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Lucas N. Silva, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Hae W. Lee, MD,PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Maria Martin, MD, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Daniel Delgado, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Marcos F. Docema, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Claudia D. Leite, MD, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Giovanni G. Cerri, MD,PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

diegojoseleao@yahoo.com.br

TEACHING POINTS

1. To review the imaging findings associated with pseudoprogression, tumor progression, radionecrosis and pseudoresponse according to Response Assessment in Neuro-Oncology (RANO) criteria for high-grade and low-grade gliomas 2. To discuss the differential diagnosis among such entities and correlate with the findings on advanced techniques such as perfusion and spectroscopy

TABLE OF CONTENTS/OUTLINE

Brief historic of the RANO criteria development and recent modifications Definition of measurable disease, non-measurable disease, and target lesions Discussion of treatment options for brain tumors and relevant imaging findings associated with them Practical evaluation of brain tumors through RANO criteria This presentation will stress: - The importance of post-operative imaging in the first 48 hours and the concept of maximal safe resection - Tumor response (complete or parcial) - Tumor progression - Pseudoprogression - Pseudoresponse after bevacizumab (anti-VEGF agent) Sample cases and differential diagnosis Summary

ROS-SUB

Radiation Oncology Sunday Poster Discussions

Sunday, Nov. 25 1:00PM - 1:30PM Room: RO Community, Learning Center

RO

AMA PRA Category 1 Credit ™: .50

Participants
Kathleen Horst, MD, Stanford, CA (*Moderator*) Nothing to Disclose

Sub-Events

RO202-SD-SUB1 Pulsed Reduced Dose Rate Re-Irradiation (PRDR) Using Modulated Arc (mARC) IMRT For Recurrent Gliomas: Initial Clinical Outcomes of a Novel Technique

Station #1

Participants
Vanica Guignard, Wauwatosa, WI (*Presenter*) Nothing to Disclose
Sara Kelm, Wauwatosa, WI (*Abstract Co-Author*) Nothing to Disclose
Benjamin Gillingham, Wauwatosa, WI (*Abstract Co-Author*) Nothing to Disclose
Selim Y. Firat, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Douglas Prah, PHD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Christopher J. Schultz, MD, Milwaukee, WI (*Abstract Co-Author*) Medical Advisory Board, Prism Clinical Imaging, Inc
Anupriya Dayal, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Jennifer Connelly, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Wade M. Mueller, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Joseph A. Bovi, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Malika L. Siker, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

vguignard@mcw.edu

PURPOSE

Limited salvage options exist for patients with recurrent malignant brain tumors after standard treatment. Pulsed reduced dose rate re-irradiation (PRDR) lowers the effective dose rate, potentially decreasing toxicity by allowing for greater sublethal damage repair in normal using a 3DRT technique. We developed a novel technique using PRDR with modulated arc (mARC) IMRT delivery to reduce the amount of normal tissue exposed and will report our initial clinical results using this.

METHOD AND MATERIALS

We conducted a retrospective review of all brain tumor patients treated with mARC PRDR at our institution. All mARC PRDR plans were generated with Monaco (Elekta Inc) using 1/10 of the total prescription dose. For each treatment fraction a total of 10 identical treatment beams were delivered with a minimum time interval of 3 min between beam initiations. This technique allows for the entire treatment volume to receive exactly 1/10 of the prescription dose every 3 min while limiting the prescription dose rate to less than 0.0667 Gy/min.

RESULTS

34 patients were treated with mARC PRDR. Primary histology included grades 2 (n=6), 3 (n=10), and 4 (n=15) gliomas. Median dose at initial RT was 60 Gy (range 48-70) at 1.8-2 Gy per fraction. Patients were heavily pre-treated with a mean of 3 prior recurrences (range 1-7) before PRDR. 19 patients had repeat resection at recurrence including 6 just prior to PRDR. Bevacizumab was previously given to 16 patients with 26 receiving bevacizumab while undergoing PRDR (dose 10 mg/kg or 5 mg/kg q2 weeks). All patients had a KPS of 70 or greater. Mean age at PRDR was 53 (range 3-71). Median interval between initial RT and PRDR was 4.75 years (range 0.5-18.3). Median total dose was 54 Gy (range 30-60) at 2 Gy per fraction. At a mean follow-up of 9.3 months (range 0.5-19.3), 6-month OS was 70.5% and 1-year was OS 23.5%. Median time to progression was 6 months with 6-month PFS 47% and 1-year PFS 17.6%. Patients who received concurrent bevacizumab didn't have any improvement in PFS or OS ($p>0.1$). Five of the 34 patients did not finish treatment due to clinical decline and/or tumor progression.

CONCLUSION

This technique appears to be safe, feasible, and well-tolerated for previously-irradiated patients with recurrent gliomas.

CLINICAL RELEVANCE/APPLICATION

This is the first clinical report of mARC IMRT PRDR for recurrent gliomas and we await long-term clinical data to better define efficacy and toxicity.

RO203-SD-SUB2 Patterns of Regional Lymph Node Recurrence After Definitive Radiotherapy for Cervical Cancer Patients

Station #2

Participants
Shintaro Tsuruoka, Toon, Japan (*Presenter*) Nothing to Disclose

Masaaki Kataoka, MD, Matsuyama, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasushi Hamamoto, MD, Toon-City, Japan (*Abstract Co-Author*) Nothing to Disclose
Noriko Takata, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Kei Nagasaki, Toon-City, Japan (*Abstract Co-Author*) Nothing to Disclose
Teruhito Mochizuki, MD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In this study, we evaluated the pattern of lymph node recurrence after definitive radiotherapy (RT) for cervical cancer patients.

METHOD AND MATERIALS

From April 2006 to December 2012, 220 patients with cervical cancer were treated with RT in our hospital. Among these patients, 122 patients who were treated with definitive RT (external beam RT and intracavitary brachytherapy) and had more than 12 months follow-up, entered into this retrospective study. RT was delivered to the whole-pelvic field with or without para-aortic lymph node area depending on that involvement status. Total median dose was 50.4 Gy. Intracavitary brachytherapy was performed in median 4 fractions, median 6 Gy per fraction to a typically prescribed point A.

RESULTS

The median age was 61 years old (26 to 90). The median follow-up was 60.7 months (5.7 to 123 months). The numbers of patients with FIGO stage IB, II, III, and IV were 23, 54, 43, and 2, respectively. The numbers of patients with cN0 and cM1 were 50 and 13. Three-year OS for FIGO stage IB, II, III, and IV were 86.7%, 75.3%, 74.4%, and 50.0%, respectively. Three-year DFS were 82.4%, 60.6%, 55.8%, and 50.0%, respectively. A total of 45 patients (36.9%) relapsed after definitive treatment: 19 (15.6%) developed local, 23 (18.9%) developed regional, and 15 (12.3%) developed distant metastasis. The median time to recurrence from the treatment was 11.9 months (range, 1.9 to 70.7 months). Among 23 patients of regional recurrence, 12 patients recurred in-field and 18 patients recurred out-field (maginal zone of RT field: 11 (61.1%) patients).

CONCLUSION

Most regional recurrences after definitive RT for cervical cancer were marginal failure. It may be necessary to consider the radiation field for patients with high recurrence risk.

CLINICAL RELEVANCE/APPLICATION

Most regional recurrences after definitive RT for cervical cancer were marginal zone.

RO001-EB-SUB MRI of Malignant Neoplastic Brachial Plexopathy: A Pictorial Review

Hardcopy Backboard

Participants
Sandra Ortiz, Mexico City, Mexico (*Presenter*) Nothing to Disclose
Adolfo E. Lizardo, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Diego Reyes, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Jorge Guerrero Lxtlahuac, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Juan Armando Reyes Perez, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. To review the anatomy of the brachial plexus and its correlation with MR. 2. To describe a series of cases that illustrate the most common sources of neoplastic infiltration of the brachial plexus (lymph node metastases and involvement by contiguity). 3. To describe the irradiation-induced brachial plexopathy as an important differential diagnosis to consider.

TABLE OF CONTENTS/OUTLINE

I. Introduction II. Anatomy III. Neoplastic brachial plexopathy due to lung and breast lymph node metastasic disease. IV. Neoplastic Brachial Plexopathy due to primary extrinsic brachial plexus tumors. V. Irradiation-induced Brachial Plexopathy V. Conclusions

RC120

Near Misses and Errors in Diagnostic Radiology and Radiation Oncology: What to Do Next?

Sunday, Nov. 25 2:00PM - 3:30PM Room: S404AB

RO SQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Abhishek A. Solanki, MD, Maywood, IL (*Moderator*) Consultant, Blue Earth Diagnostics Ltd Advisory Board, Blue Earth Diagnostics Ltd

Sub-Events

RC120A Radiation Incidents in Diagnostic Radiology: What is the Role of the Physicist?

Participants
Christopher H. Cagnon, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify areas of risk or potential staff and patient harm that may involve the diagnostic physicist. 2) Review emerging arenas of potential responsibility for the diagnostic physicist including regulatory and accreditation requirements, patient consults, and institutional priorities. 3) Discuss strategies for navigating gaps between responsibility and control from the physicist perspective. 4) Review practices and preventative measures that can control and mitigate potential problems and risk. 5) Actions that can/should be taken by the physicist in the event of emergencies or accidents.

RC120B Radiation Incidents in Radiation Oncology: What Does the Physicist Do Next?

Participants
Eric Ford, PhD, Seattle, WA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

eford@uw.edu

LEARNING OBJECTIVES

1) Understand the basics of investigating a near-miss or incident event including root-cause analysis. 2) Appreciate how incident learning data can inform the QA procedures of physicists. 3) Learn the new recommendations related to the physics review of plans and charts.

ABSTRACT

Near-miss and incident events in healthcare provide an opportunity for learning and improving care. Here I focus on practical aspects of this process as it relates to the medical physicist in radiation oncology. I will briefly review the basics structure of incident learning and how and incident investigation is conducted using root cause analysis. Data and experience from incident learning can inform the QA procedures that physicists perform and, in particular, the review of plans and charts be a physicist prior to treatment. I will review the new recommendations are emerging around this practice which are informed by incident reports from national and international systems.

RC120C Radiation Incidents in Diagnostic Radiology: What Does the Diagnostic Radiologist Do Next?

Participants
Kimberly E. Applegate, MD, MS, Lexington, KY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

keapple@uky.edu

LEARNING OBJECTIVES

1) To examine diagnostic radiology settings to ensure radiation incidents do not occur. 2) To develop a plan of action for post radiation incident evaluation. 3) To reflect on processes such as quality control, assurance, and PQI training, with a short list of resources.

RC120D Radiation Incidents in Radiation Oncology: What Does the Radiation Oncologist Do Next?

Participants
Naomi R. Schechter, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe strategies for responding to variety of potential near misses and errors in radiation oncology department 2) Describe strategies for learning from near misses and errors in radiation oncology department for purposes of quality improvement and prevention of future errors.

ABSTRACT

In a radiation oncology department, incidents can range from minor to severe. We take them all seriously. Due to our many checks and balances, it is unusual for an error to reach the patient. In the rare case that an error does reach the patient, most can be corrected for, with minimal if any harm to the patient. Our goal is to learn from every incident, review our processes and continually improve the delivery of radiation therapy to prevent futureerrors from occurring.

Active Handout:Naomi Rachel Schechter

http://abstract.rsna.org/uploads/2018/18001717/RSNA 2018 Radiation Incidents RC120D.pdf

RC122

Anatomical MR Imaging for Radiotherapy Planning and Guidance

Sunday, Nov. 25 2:00PM - 3:30PM Room: S103AB

MR PH RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Kristy K. Brock, PhD, Houston, TX (*Moderator*) License agreement, RaySearch Laboratories AB

Sub-Events

RC122A State of the Art in Anatomical MR Imaging

Participants
Aradhana M. Venkatesan, MD, Houston, TX (*Presenter*) Research Grant, Canon Medical Systems Corporation;

RC122B Clinical Need for Anatomical MR Imaging in Radiation Therapy

Participants
Cynthia Menard, MD, Montreal, QC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the various roles of MRI in radiotherapy practice. 2) Identify pitfalls in integrating MRI in radiotherapy planning. 3) Describe anatomical sites where the integration of MRI is established as standard-care.

RC122C Technical Challenges in the Integration of Anatomical MR Imaging into Radiotherapy

Participants
Carri Glide-Hurst, PHD, Detroit, MI (*Presenter*) Researcher, ViewRay, Inc; Research Consultant, Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Researcher, Modus Medical Devices Inc; Equipment support, Medspira, LLC; Equipment support, QFix

LEARNING OBJECTIVES

1) To understand the unique imaging challenges and benefits for incorporating MRI into radiation therapy treatment planning. 2) To describe the magnetic resonance simulation (MR-SIM) process to yield images that are more robust for radiation therapy planning. 3) To describe emerging technologies in MR-only treatment planning and MR-guided radiation therapy and opportunities for collaboration between imaging and radiation therapy colleagues.

MSRO21

BOOST: Head and Neck-Nasopharynx & Perineural Spread (Interactive Session)

Monday, Nov. 26 8:30AM - 10:00AM Room: E450A

HN NR OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Sub-Events

MSRO21A Imaging of the Nasopharynx: Applied Anatomy

Participants
Suresh K. Mukherji, MD, Northville, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the normal anatomy of the nasopharynx. 2) Explain common spread patterns of nasopharyngeal carcinoma. 3) Describe the anatomy landmarks that determine staging of nasopharyngeal carcinoma.

ABSTRACT

This course will review the normal anatomy of the nasopharyx and common spread patterns of nasopharyngeal carcinoma. The new AJCC 8th edition staging for nasopharyngeal carcinoma will also be reviewed.

MSRO21B Current Concepts and Controversies in Radiation Planning of the Nasopharynx

Participants
Sung Kim, MD, New Brunswick, NJ (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review important points in contouring nasopharynx cancer based on patterns of spread.

MSRO21C Question & Answer

MSRO21D Anatomy and Imaging of Perineural Spread

Participants
Suresh K. Mukherji, MD, Northville, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe common pathways of perineural spread. 2) Review the imaging findings of perineural spread. 3) Describe the proper imaging technique for being able to detect perineural spread.

ABSTRACT

This lecture will review the common perineural spread patterns of tumprs involving the nasopharynx and skull base. The emphais will be on perineural spread along the cranial nerves and also review how to optimize imagign techniques.

MSRO21E Current Concepts and Controversies in Contouring and Treatment of Perineural Spread

Participants
Sung Kim, MD, New Brunswick, NJ (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To identify and discuss some common scenarios when perineural invasion is found in head & neck cancer and how they should be treated with radiation therapy.

MSRO21F Question & Answer

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

MSRO25

BOOST: Breast-Oncology Anatomy (Interactive Session)

Monday, Nov. 26 8:30AM - 10:00AM Room: S103CD

BR OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants

Stephanie Markovina, MD, PhD, Saint Louis, MO (*Moderator*) Nothing to Disclose
Amy M. Fowler, MD, PhD, Madison, WI (*Presenter*) Research support, General Electric Company
Maria A. Thomas, MD, PhD, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand breast and regional lymph node anatomy. 2) Become familiar with basic anatomic structures and breast pathology using various imaging modalities. 3) Be familiar with breast and regional lymph node contouring techniques used in radiation treatment planning for breast cancer. 4) Apply contouring knowledge to inform radiation treatment planning for breast cancer.

RC220

What Radiologists Need to Know about the Evolving Treatment of Brain Metastases?

Monday, Nov. 26 8:30AM - 10:00AM Room: S404CD

NR RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Timothy J. Kruser, MD, Chicago, IL (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

tkruser@nm.org

LEARNING OBJECTIVES

1) Identify clinical factors that may favor radiosurgery versus whole brain RT. 2) Describe the imaging changes seen when immunotherapy is combined with radiosurgery. 3) Define current Response Assessment in Neuro-Oncology Brain Metastases guidelines. 4) Differentiate the role of steroids and bevacizumab in management of post-radiosurgery inflammation.

Active Handout:Timothy J. Kruser

http://abstract.rsna.org/uploads/2018/18001718/Brain met RSNA kruser handout RC220.pdf

Sub-Events

RC220A The Evolving Role of Radiosurgery and Whole Brain RT in Brain Metastases

Participants
Timothy J. Kruser, MD, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Active Handout:Timothy J. Kruser

http://abstract.rsna.org/uploads/2018/18001719/Brain met RSNA kruser handout RC220A.pdf

RC220B Combining Stereotactic Radiosurgery with Immunotherapy/Targeted Therapy for Brain Metastases

Participants
Veronica Chiang, MD, New Haven, CT (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Active Handout:Veronica Chiang

http://abstract.rsna.org/uploads/2018/18001720/RC220B 11.24.pdf

RC220C Imaging Response Assessment for Brain Metastases

Participants
Timothy J. Kaufmann, MD, Rochester, MN (*Presenter*) Consultant, SpineThera

LEARNING OBJECTIVES

View learning objectives under main course title.

RC220D Reirradiation of Brain Metastases; Management of Local Failures

Participants
Caroline Chung, MD, FRCPC, Houston, TX (*Presenter*) Research Grant, Elekta AB; Research Grant, RaySearch Laboratories AB; Advisory Board, RaySearch Laboratories AB; Advisory Board, Novocure Ltd

LEARNING OBJECTIVES

View learning objectives under main course title.

RC222

Functional MR Imaging for Tumor Targeting in Radiotherapy

Monday, Nov. 26 8:30AM - 10:00AM Room: S502AB

MR PH RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Kristy K. Brock, PhD, Houston, TX (*Moderator*) License agreement, RaySearch Laboratories AB

Sub-Events

RC222A State of the Art in Functional MR Imaging for Tumor Targeting

Participants
R. Jason Stafford, PhD, Houston, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jstafford@mdanderson.org

LEARNING OBJECTIVES

1) Identify some advanced and emerging MRI techniques which inform on tumor physiology and metabolism. 2) Explain the relevance of functional MR observations to basic underlying tumor physiology and biology. 3) Understand key limitations and tradeoffs of functional MR techniques for tumor assessment.

RC222B Clinical Need for Functional MR Imaging for Tumor Targeting in Radiation Therapy

Participants
Michelle M. Kim, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

michekim@med.umich.edu

LEARNING OBJECTIVES

1) Describe the major limitations of anatomic imaging for tumor target delineation in radiation therapy2) Identify key physiologic and functional MRI techniques of value in radiation treatment planning3) Explain emerging concepts of radiation treatment-individualization using advanced MRI techniques

RC222C Technical Challenges in the Integration of Functional MR Imaging for Tumor Targeting into Radiotherapy

Participants
Ning Wen, PHD, Detroit, MI (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

nwen1@hfhs.org

LEARNING OBJECTIVES

This presentation is going to review the technical challenges to integrate the functional MR Imaging into radiotherapy including the following aspects: 1) Patient positioning variation; 2) geometrical accuracy consideration; 3) reproducibility of functional imaging across different institutions/scanners/protocols; 4) precision to identify the boundary of the targets; 5) quantitative relationships among different imaging modalities.

MSRO22

BOOST: CNS-Case-based Multidisciplinary Review (Interactive Session)

Monday, Nov. 26 10:30AM - 12:00PM Room: S103AB

NR OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants

Christina I. Tsien, MD, Saint Louis, MO (*Presenter*) Advisory Board, AbbVie Inc; Advisory Board, NovoCure Ltd; Speakers Bureau, Varian, Inc; Speakers Bureau, Merck & Co, Inc
Soonmee Cha, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Roger Stupp, MD, Chicago, IL (*Presenter*) Spouse, Employee, Novartis AG; Research Consultant, Celgene Corporation; Research Consultant, AbbVie Inc; Research Consultant, Boehringer Ingelheim
Gavin P. Dunn, MD, PhD, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review latest advances in imaging for assessment of gliomas before, during, and after therapy in the context of WHO 2016 molecular/genetic classification gliomas 2) Discuss challenges and strategies for accurate imaging characterization of gliomas following therapy in a case based format. 3) Recognize the need to incorporate molecular/genetic features and types of therapy in imaging assessment of gliomas

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

MSRO26

BOOST: Gynecologic-Case-based Multidisciplinary Review (Interactive Session)

Monday, Nov. 26 10:30AM - 12:00PM Room: S103CD

GU OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Susanna I. Lee, MD,PhD, Boston, MA (*Moderator*) Editor, Wolters Kluwer nv
Lilie Lin, MD, Houston, TX (*Presenter*) Investigator, AstraZeneca PLC
Aoife Kilcoyne, MBBCh, Boston, MA (*Presenter*) Nothing to Disclose
Marcela G. Del Carmen, MD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

slee0@mgh.harvard.edu

LEARNING OBJECTIVES

1) Understand the surgical treatment of gynecologic cancers based on standard of care current treatment strategies. 2) Understand systemic therapies available for the management of gynecologic cancers based on current standard of care regimens. 3) Understand the use of radiotherapy techniques used for the adjuvant and definitive management of gynecologic cancers. 4) Identify key imaging findings on MR and PET CT pertinent to pre-operative treatment planning as well as post treatment follow up. 5) Detect common pitfalls on MR and PET CT imaging in the pre and post treatment evaluation of patients with gynecologic cancer.

ABSTRACT

This is a case based, multidisciplinary review of gynecologic malignancies.

SPCP21

Australia and New Zealand Present: Clinical Radiology and Radiation Oncology

Monday, Nov. 26 10:30AM - 12:00PM Room: E351

ED IR NR RO VA

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 0

LEARNING OBJECTIVES

1) Overview of the RANZCR Clinical Radiology Curriculum and its adoption of the CanMEDS framework. 2) Insight into the aims of RANZCR's 2016-2020 Training and Assessment Reform project and the progress to date. 3) Describe RANZCR assessment processes for radiology training - existing methods and reform initiatives. 4) Understand how RANZCR's approach fits into the broader context of specialty training programs in Australia and New Zealand. 5) Understand how RANZCR's educational model compares with correspondent radiology training programs in North America and Europe.

ABSTRACT

In 2014 the RANZCR commissioned a full review of its assessment and examination processes for Fellowship training, across both its Faculties. Expert educationalists were engaged to evaluate the quality and sustainability of RANZCR's assessment and examination program at both the operational and strategic levels, and to recommend and facilitate suitable strategies for improvement. In 2016 the College commenced a comprehensive set of work packages to implement the recommendations and develop a best-practice medical education program.

Sub-Events

SPCP21A Introduction

Participants
John P. Slavotinek, MBBS, Adelaide, Australia (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

john.slavotinek@sa.gov.au

LEARNING OBJECTIVES

1. To provide a basic overview of Australian and New Zealand demographics in comparison to other entities such as the USA, the European Union and the UK. 2. To convey brief insight into similarities and differences between the Australian and New Zealand health care environments and other countries. 3. To give perspective regarding radiology and radiation oncology services in Australia and New Zealand compared to other entities such as the USA, Europe and the UK.

SPCP21B Education, Training and Reform Initiatives in Australia and New Zealand in Radiology

Participants
Dinesh K. Varma, FRANZCR, Brighton, Australia (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Overview of the RANZCR Clinical Radiology Curriculum and its adoption of the CanMEDS framework. 2) Insight into the aims of RANZCR's 2016-2020 Training and Assessment Reform project and the progress to date. 3) Describe RANZCR assessment processes for radiology training - existing methods and reform initiatives. 4) Understand how RANZCR's approach fits into the broader context of specialty training programs in Australia and New Zealand. 5) Understand how RANZCR's educational model compares with correspondent radiology training programs in North America and Europe.

ABSTRACT

In 2014 the RANZCR commissioned a full review of its assessment and examination processes for Fellowship training, across both its Faculties. Expert educationalists were engaged to evaluate the quality and sustainability of RANZCR's assessment and examination program at both the operational and strategic levels, and to recommend and facilitate suitable strategies for improvement. In 2016 the College commenced a comprehensive recommend and facilitate suitable strategies for improvement. In 2016 the College commenced a comprehensive set of work packages to implement the recommendations and develop a best-practice medical education program.

SPCP21C Radiation Oncology and Interventional Oncology: A Marriage Made in Heaven

Participants
Lizbeth Kenny, MD, FRANZCR, Herston, Australia (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

lizkenny@bigpond.net.au

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Radiation Oncology and Radiology started as the one discipline with all knowledge housed within one person and one specialty, they diverged and are now coming closer together once more. Both, by their very nature are imaging guided specialties. Interventional Radiology and in particular Interventional Oncology and Radiation Oncology are two sides of a coin, same aim, different modalities. Radiation Oncology has a century of science and collaboration behind its practice, with a massive evidence base, hard core clinical practice and a robust research capability. Interventional Oncology internationally, is still at its infancy, but in partnership with radiation oncology, we can refocus the importance of local cancer control which the world has largely forgone in pursuit of systemic therapy. The partnership can provide a robust framework within which to practice and research. The partnership between radiation oncology and interventional oncology will rapidly propell the importance of local cancer treatment and the amazing benefit that this brings to patients and to the system. This partnership can not only help the world at large to refocus on the importance of local cancer control, but can help us reshape the evidence paradigm, which using current accepted international criteria, makes it almost impossible to obtain high level evidence in our fields of rapidly evolving technology. With a major re-focus on patient reported outcome measures, quality of life and overall economic burden, local image guided therapy, by any modality, can bring great benefit to patients and to the system alike. This is a time for overt collaboration, given the burden of cancer in the community and the lack of resources world wide. With a clear appreciation of the overall benefit of such a relationship, within Australia and New Zealand, Interventional Oncology has now formed a special interest group within our highly successful bi-national radiation oncology research group - the Trans Tasman Radiation Oncology Group (TROG) and a number of major hospital facilities in Australia are considering partnership arrangments within their services.

SPCP21D A Journey in Vascular Interventional Research: Lessons Learnt and Future Prospects

Participants
Andrew H. Holden, FRANZCR, Auckland, New Zealand (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPCP21E The Role of Iron in Neurodegeneration

Participants
Patricia Desmond, MD, Melbourne, Australia (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

Learning objectives 1. Understand the importance of iron in normal brain function 2. Understand how iron can led to neurodegeneration 3. Appreciate that Iron can be measured and imaged with MRI 4. Give insight into the role that iron may play in predicting cognitive decline.

ABSTRACT

Iron plays an essential role in normal brain function. It is important in synaptic transmission, mitochondrial respiration and myelin synthesis. Iron in the brain increase with age. However, too much iron is toxic and leads to oxidative stress and neurodegeneration. Iron is associated with neurodegeneration in Parkinson's disease and Parkinson's dementia and has also been linked to other neurodegenerative diseases including Alzheimer's disease. Increase iron levels and found in the brain of AD patients at post mortem. Increase iron in the CSF is a predictor of cognitive decline in amyloid positive patients Amyloid imaging has revolutionised our understanding of AD disease. It points to a long preclinical phase, 20 to 30 years of gradual build up before the onset of clinical disease. However, amyloid does not tell us about when a patient will dement. Approximately 30% of normal healthy elderly will have a positive amyloid scan. Iron can now be imaged quantitatively with MRI by a technique known as Quantitative Susceptibility Mapping (QSM). Increase iron in the hippocampus, measured with QSM in amyloid positive patients predicts decline 5 years before onset. Iron chelation in amyloid positive patients is currently being trialed as a way of delaying onset of cognitive impairment

SPCP21F Closing Remarks

Participants
Vijay M. Rao, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

SSC14

Science Session with Keynote: Radiation Oncology (CNS Malignancies)

Monday, Nov. 26 10:30AM - 12:00PM Room: E353A

NR RO OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Martin Colman, MD, Houston, TX (*Moderator*) Stockholder, Steward Health Care
John C. Grecula, MD, Columbus, OH (*Moderator*) Research Grant, Teva Pharmaceutical Industries Ltd; Research Grant, Soligenix, Inc;

Sub-Events

SSC14-01 Radiation Oncology Keynote Speaker: CNS

Monday, Nov. 26 10:30AM - 10:50AM Room: E353A

Participants
Hany Soliman, Toronto, ON (*Presenter*) Nothing to Disclose

SSC14-03 Fractionated Radiosurgery Compared to Single Fraction Radiosurgery in the Treatment of Unresected Large Brain Metastases: An International Meta-Analysis

Monday, Nov. 26 10:50AM - 11:00AM Room: E353A

Participants
Eric J. Lehrer, MD, New York, NY (*Presenter*) Nothing to Disclose
Jennifer L. Peterson, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose
Nicholas G. Zaorsky, MD, Hershey, PA (*Abstract Co-Author*) Nothing to Disclose
Paul D. Brown, MD, Rochester, MN (*Abstract Co-Author*) Speaker, Wolters Kluwer nv; Data Safety Monitoring Board, Novella Clinical
Veronica Chiang, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Jason Sheehan, MD,PhD, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
Arjun Sahgal, Toronto, ON (*Abstract Co-Author*) Speaker, Medtronic plc; Speaker, Elekta AB; Medical Advisory Board, Varian Medical Systems, Inc; Speaker, Accuray Incorporated; Research Grant, Elekta AB
Samuel T. Chao, MD, Cleveland, OH (*Abstract Co-Author*) Speaker, Varian, Inc; Speaker, NovoCure Ltd
Daniel M. Trifiletti, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

ericjlehrer@gmail.com

PURPOSE

SRS is commonly utilized as a definitive therapy in patients with unresected large brain metastases (BrM), as it provides excellent rates of 1-year local control (LC); however, resultant radionecrosis (RN) is a known risk. fSRS is a treatment option intended to reduce the incidence of RN and improve LC in these patients. There is a paucity of prospective data comparing these two modalities; therefore, a meta-analysis of existing retrospective and prospective studies was conducted.

METHOD AND MATERIALS

The co-primary outcome measures were incidence of RN and LC at 1 year. Large BrM were defined according to Radiation Therapy Oncology Group 90-05, where Group A: 2-3 cm diameter (4-14 cc volume) and Group B: >= 3 cm diameter (>14 cc volume). PICOS/PRISMA/MOOSE guidelines were used to select studies where patients with large BrM: (1) RN rates and/or 1-year LC were available; (2) SRS and/or fSRS were administered as treatment for unresected metastases; (3) data regarding tumor size were reported. Weighted random effects meta-analyses were used to analyze RN and 1-year LC. Fractionation and size were analyzed as moderators using analysis of variance and omnibus test where the null hypothesis was rejected for $p<0.05$.

RESULTS

A total of 17 studies conducted from 1998-2016, in 6 nations, consisting of 1,007 large BrM, met inclusion criteria. Median patient age was 62 years, median follow up was 9.5 months, and the most commonly used radiosurgery platform was Gamma Knife (9/17 studies). The range of SRS doses was 15-20 Gy, and the range of fSRS doses was 24-35 Gy in 2-5 fractions. The most common SRS dose was 18 Gy/1 fraction, and the most common fSRS dose was 27 Gy/3 fractions. Incidence of RN at 1-year for all studies was 9.2%; and was 18.2% for SRS and 6.7% for fSRS, $p=0.008$. 1-year LC for all studies was 79.3%; and was 74.0% for SRS and 83.4% for fSRS, $p=0.20$. By tumor volume, the incidence of RN in Group A was 10.5% and in Group B was 7.7%, $p=0.51$. 1-year LC in Group A was 86.2% and in Group B was 76.3%, $p=0.07$.

CONCLUSION

Among patients with unresected large BrM treated with radiosurgery, fSRS is associated with decreased rates of RN and potentially improved 1-year LC compared to SRS.

CLINICAL RELEVANCE/APPLICATION

Fractionated stereotactic radiosurgery (fSRS) is a recent advancement in radiosurgery, although its relative safety and efficacy compared to single fraction stereotactic radiosurgery (SRS) is unknown.

SSC14-04 The Dancing Cord: Inherent Spinal Cord Motion and Its Effect on Cord Dose in Spine Stereotactic Body Radiation Therapy

Monday, Nov. 26 11:00AM - 11:10AM Room: E353A

Participants
Murat A. Oztek, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Simon S. Lo, MD, Seattle, WA (*Abstract Co-Author*) Editor, Springer Nature;
Mahmud Mossa-Basha, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Matthew J. Nyflot, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Patricia A. Sponseller, MS,CMD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Wei Wu, MD, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose
Christoph P. Hofstetter, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Rajiv Saigal, MD,PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Stephen R. Bowen, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
William T. Yuh, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Nina A. Mayr, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

oztekma@uw.edu

PURPOSE

Adherence to strict dose limits is critically important in stereotactic body radiation therapy (SBRT) for spine tumors to reduce the risk of neurologic complications. Validated dose constraints have been established. However, inherent motion of the spinal cord has not yet been explored with respect to dosimetric effects in spine SBRT.

METHOD AND MATERIALS

Dynamic cardiac-gated balanced fast field echo MR imaging was obtained as part of routine treatment planning imaging for VMAT-based spine SBRT in 8 patients with spine tumors. Imaging and dosimetric data were analyzed in a retrospective IRB approved study. Planning CT data sets, static T2-weighted (cordstat), and each of 15 phases of the dynamic MRI images (corddyn) were coregistered. Cord deformation and motion on the dynamic imaging was compared to the static T2-weighted images, with respect to cord area, Dice coefficient, Jaccard index and excursion of the corddyn beyond the cordstat and planning organ at risk volume (PRV) margins. Dose was compared between cordstat, and corddyn. Comparisons were made using the Wilcoxon signed rank test.

RESULTS

The cross-sectional areas were not significantly different between cordstat and corddyn (0.51±0.12 vs. 0.52±0.13 mm2, p=0.814), suggesting no major cord deformation. Assessing cord motion, Dice coefficient between cordstat vs. corddyn ranged from 0.70 to 0.96 (mean, 0.85±0.05). Jaccard index ranged from 0.54 -0.92 (mean, 0.75±0.08). In 4 of the 8 patients, the maximal dose to corddyn exceeded that of cordstat by 1.2 - 12.8% (mean 5.2±4.3%). The corddyn spatially moved outside the 1 mm PRV margin of cordstat in 4 of the 8 patients: 13% of the time in 2, and 27% of the time in 2 patients. Corddyn did not extend outside the 2 mm PRV margin of cordstat.

CONCLUSION

The spinal cord shows inherent motion, resulting in measurable dosimetric effects which should be considered during SBRT dosimetry. A PRV margin of 2 mm surrounding the cord is suggested to account for the inherent spinal cord motion.

CLINICAL RELEVANCE/APPLICATION

Accurate imaging of the spinal cord is critical to assure dose limits and prevent neurologic complications in patients receiving high-precision/high-dose stereotactic body radiation for spine tumors.

SSC14-05 Two-Fraction Radiosurgery (9Gy x 2) is an Effective and Safe Option in the Modern Era of CNS Penetrating Systemic Therapies

Monday, Nov. 26 11:10AM - 11:20AM Room: E353A

Awards
Student Travel Stipend Award

Participants
Andrew Huang, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Karen E. Huang, MS, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Rahul Kumar, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Arun Goel, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Nima Harandi, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Samuel R. Birer, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Mark C. Rounsaville, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
John Lee, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Roy Abendroth, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

huangaj@sutterhealth.org

PURPOSE

In the era of CNS-penetrating systemic therapies, stereotactic radiosurgery (SRS) has resulted in higher intracranial control rates

as well as higher rates of radionecrosis. We sought to determine if lower biologically equivalent dose SRS, specifically 18Gy in 2 fractions (fx), can achieve adequate local control with reduced adverse events.

METHOD AND MATERIALS

We retrospectively reviewed patients who received SRS in our department from 2014-2015. In this period, we had implemented a fractionated SRS regimen of 18Gy in 2fx for >3 simultaneously treated lesions, with all lesions typically being <2 cm which some exceptions. Median GTV-PTV expansion was 2mm (range 0-5mm). Dose was prescribed to the periphery to the 65-90% isodose line. We documented lesion location, prior radiation, volume, largest single dimension, and if symptomatic radionecrosis occurred. Cancer subtype, systemic therapies, cause of death, and performance status was included as well. Cox proportional hazards models were used to determine factors affecting local control.

RESULTS

From 2014-2015, we treated 242 lesions from 59 patients using stereotactic radiosurgery. Within this cohort, 126 lesions from 27 patients were treated using 18Gy in 2fx. 22 of 27 patients treated using these two fraction regimens were followed until death. The majority of lesions of the two-fraction cohort came from a melanoma primary (n=94). Ten lesions were resected before SRS. For the two fraction regimen, local control was 59% at 1-year, and 59% at 2-years. Radionecrosis occurred in 2 lesions (1.6%). The majority of lesions (n=88) were <1cc, 35 were 1-10cc in volume, and the remaining 3 were 10-98cc in volume. On multivariate analysis of the entire cohort, maximum single dimension, and prior surgical resection were independent predictors of local failure. Number of fractions was not significantly associated with local failure.

CONCLUSION

In our cohort, 18Gy in 2fx delivered acceptable local control with very low rates of symptomatic radionecrosis.

CLINICAL RELEVANCE/APPLICATION

Lower-dose, two-fractionation radiosurgery may be appropriate for patients with high volume disease, poor performance status or patients receiving central-nervous system penetrating systemic therapies.

SSC14-06 T2WI Histogram Analysis for Differentiating Glioblastoma from Solitary Brain Metastasis

Monday, Nov. 26 11:20AM - 11:30AM Room: E353A

Participants
Yong Zhang, DO, Zhengzhou, China (*Presenter*) Nothing to Disclose
Ke Xu, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose
Jingliang Cheng, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose
Qingqing Lv, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

1043381896@qq.com

PURPOSE

To study the value of T2 gray histogram analysis of differential diagnosis in glioblastoma and brain solitary metastasis.

METHOD AND MATERIALS

A retrospective analysis was conducted by brain MRI examination and pathology diagnosis of 57 cases of glioblastoma and brain solitary metastasis in our hospital .Among them, there were 29 cases of glioblastoma(there were 17 males and 12 females), 28 cases of astrocytoma(there were 15 males and 13 females).Respectively, to draw the region of interest(ROI) in the T2 MR transaxial images of two groups on maximum layer of tumor level by using Mazda software and analyze the whole tumors gray histogram, performing a statistical analysis on the two sets ofparameters obtained from histograms to find out statistical significance of each parameter.The kurtosis, skewness, the first percentile, the 10th percentile and the 90th percentile were in accordance with the normal distribution. Two independent samples t-test were used to compare the differences.Mean , Variance, the 50th percentile, the 99th percentile did not fit the normal distribution, using nonparametric test, P <0.05 was statistically significant.

RESULTS

Through histogram analysis of 9 parameters, these 7 parameters were statistically significant (all P <0.05),including mean , kurtosis,skewness, perc.10%,perc.50% ,perc.90% and perc.99%. Among them,the sensitivity of skewness was 82.1%, the specificity was 82.8%, the area under the curve was 0.865,and the best cut-off value was 0.58.

CONCLUSION

The T2WI gray histogram analysis is helpful for the identification of brain solitary metastasis from glioblastoma and the skewness has a high diagnostic efficiency.

CLINICAL RELEVANCE/APPLICATION

The T2WI gray histogram analysis is helpful for the identification of brain solitary metastasis from glioblastoma.

SSC14-08 18F-FDOPA PET/MR Based Target Definition in the 3D Based Radiotherapy Treatment of Glioblastoma Multiform Patients: Early Results of a Single Institute Study

Monday, Nov. 26 11:40AM - 11:50AM Room: E353A

Awards
Student Travel Stipend Award

Participants
David Sipos, MSc, Kaposvar, Hungary (*Presenter*) Nothing to Disclose
Zoltan Toth, Kaposvar, Hungary (*Abstract Co-Author*) Nothing to Disclose

Gabor Lukacs, Kaposvar, Hungary (*Abstract Co-Author*) Nothing to Disclose
Gabor Bajzik, MD, Kaposvar, Hungary (*Abstract Co-Author*) Nothing to Disclose
Janaki S. Hadjiev, MD, Kaposvar, Hungary (*Abstract Co-Author*) Nothing to Disclose
Imre Repa, MD, Kaposvar, Hungary (*Abstract Co-Author*) Nothing to Disclose
Arpad Kovacs, Kaposvar, Hungary (*Abstract Co-Author*) Nothing to Disclose
Marianna Moizs, Kabosvak, Hungary (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

cpt.david.sipos@gmail.com

PURPOSE

In the staging and 3D radiotherapy planning process of glioblastoma multiforme (GBM) patients conventional MRI plays important role. The 18F-F-DOPA positron emission tomography (PET) imaging utilising metabolic radiotracers for better evaluation of the affectet area by the tumor. 18F-FDOPA penetrates into the cells by a process mediated by amino acid transporters and demonstrates higher sensitivity and specificity for gliomas than traditional 18F-FDG PET and contrast enhanced MRI imaging. Our aim was to present the feasibilty of this amino acid tracer in modern 3D radiotherapy planning.

METHOD AND MATERIALS

We present a retrospective analysis of the PET/MR based planning study with 18F-FDOPA in 4 patients with histologically proven GBM. In the contouring process The native planning CT scanes were fused with the PET/MR series (T1 contrast enhanced, T2 and 18F-F-DOPA sequences). We defined 18F-F-DOPA uptake volumen (BTV-F-DOPA), the T1 contrast enhanced MRI volume (GTV-T1CE), and the volume of area covered by oedema on the T2 weighted MRI scan (CTV-oedema) in all patients. We also registered the volume BTV-F-DOPA volumes not covered by the conventional MR based target volumes.

RESULTS

The mean 18F-F-DOPA tumor volumes was 37,1 cm3 (range 15,3-80,3; SD=29,48). The mean GTV T1 CE was 7,2 cm3 (range 2,6-13,2; SD=4,89). The mean CTV oedema volume was 57,4 cm3 (range 27,7-108,8; SD=36,49). The mean volume of the BTV-F-DOPA not covered by the CTV oedema volume was 8,6 cm3 (range 1-21; SD=9,22).

CONCLUSION

Based on our results the tumor area defined by the amino acid tracer is not fully identical with MRI defined T2 oedema CTV. 18F-FDOPA defined BTV can modifie the definiton of the PTV, and the radiotherapy treatment.

CLINICAL RELEVANCE/APPLICATION

18F-FDOPA PET/MR based target definiton in the 3D based radiotherapy treatment will provide better tumour extension characterization of patients suffering from glioblastoma multiforme.

ROS-MOA

Radiation Oncology Monday Poster Discussions

Monday, Nov. 26 12:15PM - 12:45PM Room: RO Community, Learning Center

RO

AMA PRA Category 1 Credit ™: .50

Participants
Carryn Anderson, MD, Iowa City, IA (*Moderator*) Nothing to Disclose

Sub-Events

RO204-SD-MOA1 Risk Factors of Radionecrosis Subsequent of Stereotactic Radiosurgery in Patients with Brain Metastases

Station #1

Participants
Qi-Wen Li, Guangzhou, China (*Presenter*) Nothing to Disclose
Jiang Hu, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Bo Qiu, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Yu-Jia Zhu, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Fan-Jun Meng, Jieyang, China (*Abstract Co-Author*) Nothing to Disclose
Pei-Qiang Cai, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Mei-Ling Deng, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Chuan-Miao Xie, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Hui Liu, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

liuhui@sysucc.org.cn

PURPOSE

The balance between tumor response and subsequent development of radionecrosis following stereotactic radiosurgery (SRS) for brain metastasis is a major dilemma. The purpose of this study is to demonstrate the incidence and risk factors of radionecrosis by investigating serial magnetic resonance imaging (MRI) studies.

METHOD AND MATERIALS

Eighty-five brain metastases treated with linear accelerator-based SRS in a single fraction were analyzed retrospectively. Serial brains MRIs, performed at an interval of 3-6 months, were reviewed to evaluate the occurrence of radionecrosis. Clinical data was assessed to determine radionecrosis-related symptoms. Univariate and multivariate analyses were performed to reveal the potential risk factors of radionecrosis, including dosimetric data, clinicopathologic characteristics of patients, prior whole brain irradiation and the delivery of chemotherapy and/or targeted therapy.

RESULTS

Median prescribed dose was 20 (range: 14-24) Gy. After a median radiologic follow-up of 8 months, the two-year cumulative incidences of radiologic and symptomatic radionecrosis were 20.0% and 5.3%. Patients were at higher risk of radiologic radionecrosis if the ratio of in-field maximum point dose (Dmax) to prescribed dose exceeded 1.1 (p=0.033), or the volume of surrounding brain tissue receiving 20 Gy or above (V20) exceeded 1.5 cc (p=0.041). V20 exceeding 1.5 cc tended to be significantly associated with symptomatic radionecrosis (p=0.088).

CONCLUSION

Limiting the in-field maximum point dose within 110% of the prescribed dose, and ensuring V20 of the normal tissue less than 1.5 cc might be beneficial in reducing the appearance of radiologic brain radionecrosis determined on series MRIs after SRS.

CLINICAL RELEVANCE/APPLICATION

Dose limitations of both the target and normal tissue in brain SRS can reduce the incidence of brain radionecrosis determined on series MRIs.

RO205-SD-MOA2 Correlating Multi-Parametric Tumor Imaging Kinetics And Circulating Tumor Cells During Radiotherapy In Patients With Head And Neck Cancer: Preliminary Results

Station #2

Participants
Sweet Ping Ng, MBBS,FRANZCR, Houston, TX (*Presenter*) Nothing to Disclose
Carlos Cardenas, MS, Houston, TX (*Abstract Co-Author*) Research Grant, Varian Medical Systems, Inc
Houda Bahig, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Jihong Wang, PhD, Houston, TX (*Abstract Co-Author*) Speaker, Elekta AB
Salyna Meas, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Vanessa Sarli, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Carolyn Hall, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

Yao Ding, PHD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Shalin Shah, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Anthony Lucci, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Abdallah S. Mohamed, MD, MSc, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Clifton D. Fuller, MD,PhD, Houston, TX (*Abstract Co-Author*) Research Consultant, Elekta AB; Research Grant, Elekta AB; Speaker, Elekta AB

PURPOSE

To quantify and correlate imaging changes (volume of primary tumor and apparent diffusion coefficient change, ADC) on weekly MRIs with weekly circulating tumor cell (CTC) count changes.

METHOD AND MATERIALS

Patients with localized mucosal head and neck squamous cell carcinomas undergoing definitive radiotherapy were eligible for enrolment on a prospective observational study. Pre-treatment and weekly in-treatment MRIs were obtained in radiotherapy treatment position. T1-weighted, T2-weighted and DWI sequences were obtained on 1.5T Siemens MRI. ADC maps were generated. Gross tumor volume (GTV) was contoured on T2-weighted MRI. GTV volume and ADC parameters were recorded. Peripheral blood samples were collected pre-radiotherapy and weekly during radiotherapy. CTCs were assessed and quantified using the FDA-approved CellSearch System. Patient, tumor and treatment characteristics were recorded.

RESULTS

A total of 8 patients completed the study. 2 patients were excluded from the analysis - one with small primary tumor (<5cc) and another who missed an MRI. Hence, 6 patients were eligible for analysis. All patients had squamous cell carcinomas and all received concurrent chemotherapy. Three patients had oropharyngeal, 2 had laryngeal and 1 with nasopharyngeal tumors. Median pre-treatment tumor volume was 17.85cc (range: 9.4 - 33.7cc). Approximately 25% of tumor volume shrinkage happened between week 2 and 3. 5 patients achieved >50% tumor shrinkage by week 3 of treatment. The change in weekly median ADC compared to baseline was -0.3%, 2 %, 2.7%, 6.9%, -0.5%, and 6.6%. No patient had detectable CTC before treatment. After week 1, 1 patient had 2 CTCs. In week 4, 5 patients had detectable CTCs - 4 had 1 CTC and 1 had 2 CTCs. CTC became detectable or increased in week 4 - where the greatest increase in median ADC was noted and the week after greatest GTV shrinkage is seen on MRI.

CONCLUSION

No correlation between tumor response seen on MRI with circulating tumor cell count during radiotherapy. It appeared that CTC became detectable or increased in week 4 suggesting that tumor cells may be released into the circulation as the tumor microvasculature is affected by the radiation resulting in increased 'leakiness' into the vasculature. Further investigation into the viability of these cells is required.

CLINICAL RELEVANCE/APPLICATION

Although no correlation between imaging kinetics and CTC counts during radiotherapy was noted in this preliminary data, CTC release into the circulation during treatment require further investigation.

ROS-MOB

Radiation Oncology Monday Poster Discussions

Monday, Nov. 26 12:45PM - 1:15PM Room: RO Community, Learning Center

RO

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Anna Shapiro, MD, Syracuse, NY (*Moderator*) Nothing to Disclose

Sub-Events

RO207-SD-MOB1 Multiple Metastatic Melanoma: Pretreatment Contrast-Enhanced CT Texture Parameters as Predictive Biomarkers of Survival in Patients treated with Pembrolizumab

Station #1

Awards
Student Travel Stipend Award

Participants
Carole Durot, MD, Reims, France (*Presenter*) Nothing to Disclose
Sebastien Mule, MD,PhD, Creteil, France (*Abstract Co-Author*) Nothing to Disclose
Philippe A. Soyer, MD, PhD, Paris, France (*Abstract Co-Author*) Consultant, Guerbet SA
Aude Marchal, Reims, France (*Abstract Co-Author*) Nothing to Disclose
Florent Grange, Reims, France (*Abstract Co-Author*) Nothing to Disclose
Christine C. Hoeffel, MD, Reims, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine whether texture analysis features on pretreatment contrast-enhanced computed tomography (CT) images can predict progression-free survival (PFS) and overall survival (OS) in patients with multiple metastatic (MM) melanoma treated with Pembrolizumab.

METHOD AND MATERIALS

This institutional review board-approved retrospective study included 31 patients from one university hospital with MM melanoma treated with Pembrolizumab. Texture analysis of 74 metastatic lesions was performed on CT scanners obtained within one month prior to treatment. Mean grey-level, entropy, kurtosis, skewness, mean of positive pixels and standard deviation values were derived from the pixel distribution histogram before and after spatial filtration at different texture scales, ranging from fine to coarse. Univariate and multivariate Cox regression analysis were performed to identify independent predictors of PFS and OS.

RESULTS

Median PFS was 91 days (range 35-968) and median OS was 321 days (range 42-1095). Skewness at medium (hazard ratio HR = 3.82, p = 0.046) and at coarse (HR = 4.25, p = 0.017) texture scales independently predicted OS. No textural feature was identified as an independent predictor of PFS. Intrareader agreement regarding CT texture parameters was excellent for all textures parameters (skewness: ICC = 0.86). Interreader agreement was good for all textures parameters (skewness: ICC = 0.62).

CONCLUSION

Pretreatment CT texture analysis-derived tumor skewness may act as predictive biomarker of overall survival in patients with advanced MM melanoma treated with Pembrolizumab.

CLINICAL RELEVANCE/APPLICATION

Pretreatment contrast-enhanced CT Texture analysis may allow independent prediction of survival in patients with MM melanoma treated with pembrolizumab and may help to identify patients who are likely to benefit from this therapy.

RO208-SD-MOB2 The D value of Diffusion Kurtosis Imaging May Early Predict Treatment Response Within 7 Days After Radiotherapy Initiation in Loco-Regionally Advanced Nasopharyngeal Carcinoma

Station #2

Participants
Qiuyuan Yue, Fuzhou, China (*Presenter*) Nothing to Disclose
Yunbin Chen, MD, Fuzhou, China (*Abstract Co-Author*) Nothing to Disclose
Dechun Zheng, MS, Fuzhou, China (*Abstract Co-Author*) Nothing to Disclose
Ying N. Chen, PhD, Fuzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate whether the parameters of Diffusion Kurtosis Imaging (DKI) may early predict the treatment response in loco-regionally advanced nasopharyngeal carcinoma (NPC) patients who received sequential neoadjuvant chemotherapy (NAC) and radical intensity-modulated radiotherapy (IMRT).

METHOD AND MATERIALS

52 consecutive, and newly diagnosed advanced NPC patients who received sequential two cycles of platinum-based NAC, following radical IMRT and completed three scheduled MRI scans at baseline (Pre-Tx), after two cycles (42nd days) of NAC (Pre-RT), one week after RT initiation (RT-1w) were enrolled in current study. The absolute change between RT-1w and Pre-Tx, RT-1w and Pre-RT, Pre-RT and Pre-Tx were defined as Δ1,Δ2 and Δ3.The similar definitions were applied to DKI parameters. Patients were divided into responder group (RG) and non-responder group (NRG) in the third months after completion of RT according to the response evaluation criteria in solid tumors (RECIST 1.1v). Mann-Whitney U test, student's t-test, paired χ2 test, univariate and multivariate logistic regression, and receiver operating characterstics (ROC) curves were applied in statistical analysis.

RESULTS

17 patients achieved completed remission (CR), 26 patients achieved partial remission (PR) and 9 patients remained stable disease (SD). Hence, 43 patients were classified as RG and 9 patients were classified as NRG. Univariate logistic regression analysis showed that D1 (P=0.022), D2 (P=0.025), ΔD2 (P=0.008) and Chemotherapy (CT) cycles (P=0.044) were significant predictor and clinical stage was borderline significant predictor (P=0.051) for tumor response when defined RG as the primary endpoint. Next, only ΔD2 (Adjusted OR 19.36; P=0.021) and CT cycles (Adjust OR 18.17; P=0.022) were identified as independent predictors in multivariate logistic regression analysis. In addition, when defined CR as the primary endpoint, only ΔD2 was identified as the significant predictor (P=0.047).

CONCLUSION

The absolute change of D value within 7 days after RT initiation and CT cycles may serve as the independent predictors for tumor response in loco-regionally advanced NPC patients who undergo sequential NAC and IMRT.

CLINICAL RELEVANCE/APPLICATION

DKI may help to identify proper candidates to undergo sequetial NAC and IMRT thus provide a reference of tumor radiosensitivity to optimize individual therapeutic strategies.

RO209-SD-MOB3 A Phase II, Proof-of-Concept Clinical Study of an Oral Mouth Rinse Containing Sandalwood Oil (SAO) for the Prevention of Oral and Oropharyngeal Mucositis Associated with (Chemo-) Radiation Therapy in Head and Neck Cancer Patients

Station #3

Participants
Chul S. Ha, MD, San Antonio, TX (*Presenter*) Investigator, Santalis Pharmaceuticals, Inc
Ying Li, MD, San Antonio, TX (*Abstract Co-Author*) Investigator, Santalis Pharmaceuticals, Inc
Carol Jenkins, RN,MS, San Antonio, TX (*Abstract Co-Author*) Nothing to Disclose
Corey Levenson, PhD, San Antonio, TX (*Abstract Co-Author*) Officer, Santalis Pharmaceuticals

PURPOSE

Mucositis is one of the most debilitating side effects in patients treated with (chemo-) radiation therapy for head and neck cancer. This study was intended to evaluate the efficacy in alleviating mucositis, safety and tolerability of SAO (0.25% aqueous solution of an anti-inflammatory and anti-microbial essential oil from Santalum album trees).

METHOD AND MATERIALS

Patients to be treated with (chemo-) radiation therapy (>= 60 Gy) for cancers of oral cavity/oropharynx were asked to swish and gargle for 30 seconds, and spit, with 15 ml of the SAO three times a day throughout the radiation therapy. Pain in the oral cavity/oropharynx was measured using the numerical rating pain scale (NRPS) and mucositis was graded using the RTOG scale every week. Our data were compared with historical data in table 2 (incidence of mucositis), figure 1 (mean mucositis grade) and figure 2 (mean oral pain grade) from MD Anderson Cancer Center (MDACC) (doi:10.1016/j.ijrobp.2007.01.053) and table 4 (incidence of mucositis) from Memorial Sloan Kettering Cancer Center (MSKCC) (doi:10.1016/j.ijrobp.2010.10.041).

RESULTS

Fourteen subjects were enrolled but 6 withdrew (4 of them due to taste/smell of the rinse, 1 due to fatigue, 1 due to perceived ineffectiveness of the rinse). Among the 8 who completed the course of SAO treatment, 6 were treated with chemo-radiation and 2 with radiation only. IMRT was used for everyone. The median dose was 6,996 cGy in 33 fractions. There were no serious adverse events from SAO. The mean RTOG mucositis grades from weeks 3,6 and 9 were 1.125, 2.125 and 1.875. Two of 8 patients experienced mucositis >= 3. The corresponding mean NRPS were 3.700, 4.988 and 3.875.

CONCLUSION

The incidence of mucositis >= 3 were 70% from MDACC and 22% from MSKCC. Distribution of our mean NRPS and RTOG mucositis data compared favorably against figures 1 and 2 from MDACC. Though SAO was difficult to use due to poor taste/smell, it was otherwise well tolerated and appears to have enough signal to warrant further development as a potential alleviator of mucositis.

CLINICAL RELEVANCE/APPLICATION

This is a proof-of-concept clinical trial for an oral mouth rinse containing Sandalwood Oil for the prevention of mucositis associated with (chemo-) radiation therapy in head and neck cancer patients. We believe our results have generated enough signal to pursue further development of this preparation.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

MSRO23

BOOST: Head and Neck-Science Session

Monday, Nov. 26 1:30PM - 2:30PM Room: E450A

AI HN NR OI RO

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Carryn Anderson, MD, Iowa City, IA (*Moderator*) Nothing to Disclose
John C. Grecula, MD, Columbus, OH (*Moderator*) Research Grant, Teva Pharmaceutical Industries Ltd; Research Grant, Soligenix, Inc;

Sub-Events

MSRO23-01 Low-Lying Lymph Node (LLLN) Involvement in Human Papillomavirus (HPV)-Associated Oropharyngeal Carcinoma (OPC)

Monday, Nov. 26 1:30PM - 1:40PM Room: E450A

Awards
Student Travel Stipend Award

Participants
Timothy Lin, BA, Bellaire, TX (*Presenter*) Nothing to Disclose
Hesham Elhalawani, MD, MSc, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Baher Elgohari, MBBCh, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
James M. Debnam, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Amit Jethanandani, MPH, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Abdallah S. Mohamed, MD, MSc, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
S. J. Frank, MD, Houston, TX (*Abstract Co-Author*) Board Member, C4 Imaging LLC Stockholder, C4 Imaging LLC Advisory Board, Elekta AB
Erich M. Sturgis, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Jack Phan, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Jay Reddy, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Clifton D. Fuller, MD,PhD, Houston, TX (*Abstract Co-Author*) Research Consultant, Elekta AB; Research Grant, Elekta AB; Speaker, Elekta AB
William H. Morrison, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Heath Skinner, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
David I. Rosenthal, Houston, TX (*Abstract Co-Author*) Advisory Board, Bristol-Myers Squibb Company Advisory Board, Merck KGaA Research support, Merck KGaA
Adam S. Garden, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Brandon Gunn, MD, Galveston, TX (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

tlin4@mdanderson.org

PURPOSE

To characterize the incidence/pattern of LLLN involvement in HPV-associated OPC and correlation with outcomes after radiation therapy (RT).

METHOD AND MATERIALS

We reviewed diagnostic/planning images and clinical data of an IRB-approved cohort of HPV-associated OPC patients (pts) treated with definitive RT at our institution from 2004-13. Demographics and outcomes were retrieved from the medical records. LLLN+ were defined as any radiographically involved level IV or Vb nodes. AJCC 8th edition staging was used. Actuarial outcomes were calculated using Kaplan-Meier and compared by log-rank test. One-way analysis of variance was used to compare proportions.

RESULTS

In 796 pts, the incidence of LLLN+ was 12%, 13% in base of tongue and 10% in tonsil primaries, 10% in N1, 17% in N2, and 48% in N3. Median follow-up was 58 months (IQR: 42-77). Induction chemotherapy (IC) was used in 80% vs. 37% and concurrent in 78% vs. 65% for those with vs. without LLLN involvement, respectively. The proportion of LLLN+ patients receiving IC was 70%, 93%, and 100% for those with N1, N2, and N3 disease, respectively (p=.0034). Overall, LLLN+ was associated with worse 5-year rates for all disease control endpoints tested except freedom from distant metastasis (FDM) with a trend for OS. In patients with N1 disease, LLLN-involvement was associated with worse rates of FDM (87% vs. 94%, p=.0214); no significant differences were observed in N2 or N3 subgroups for any endpoint. In patients who received IC, LLLN+ was associated with worse 5-year local control (LC), regional control (RC), and relapse-free survival (RFS), differences ranging from 6-11% (p-value<0.004 for each). When stratified by IC and N-category, LLLN+ was associated with lower FDM rates in N1 (86% vs. 94%, p=.014) but not N2 or N3 disease.

CONCLUSION

Reflective of the patterns of care of those treated during this study time frame, most pts with LLLN+ received IC, which could have potentially offset any adverse correlation with subsequent distant failure. However, LLLN+ correlated with other disease control endpoints (LC, RC, and RFS), and thus could be considered a marker of regionally advanced disease in HPV-associated OPC, even for those with lower stage.

CLINICAL RELEVANCE/APPLICATION

LLLLN involvement was associated with poorer disease control outcomes, and a potential influence of IC on subsequent distant failure is hypothesized.

MSRO23-02 Automatic Gross Tumor Volume (GTV) Delineation for Nasopharyngeal Carcinoma (NPC) Radiotherapy on Multi-modal MRI: A Deep Learning Model Trained from 1000 Patient Dataset

Monday, Nov. 26 1:40PM - 1:50PM Room: E450A

Participants
Fu Li, Guangzhou, China (*Presenter*) Nothing to Disclose
Yao Lu, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Ying Sun, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Li Lin, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

lifu5@mail.sysu.edu.cn

PURPOSE

GTV delineation of NPC is a critical and time-consuming process during intensity modulated radiotherapy. We are developing an automatic deep learning GTV delineation approach for NPC radiotherapy on multi-model MRI.

METHOD AND MATERIALS

With IRB approval, we retrospectively collected 1012 patients who underwent intensity modulated radiotherapy for NPC from Sept. 2016 to Aug. 2017. Multi-model MRIs (T1, T1C, T1W, T2) were acquired for GTV delineation of each patient with Philips MR imaging system and covered large variations in scanning parameters. Three experienced radiotherapists manually marked the GTV contours on MRI series (1 to 2 hours per case). In this study, a modified 3D U-net deep learning network was trained to perform volume-to-volume delineation of GTV. Multi-modal MRIs were regard as different channel input of the 3D U-net and feature maps from various layers were concatenated with deep supervision to generate the output as the corresponding GTV likelihood map. Binary cross-entropy was applied as loss function for network training. To increase receptive fields and capture contextual information, two-stride convolution was used to downsample feature maps instead of maxpooling operator. Besides, clinical anatomy characteristics were explored as post-processing to protect normal tissues and further improve the model performance. We randomly split the entire data set into training (850 cases) and independent testing (162 cases). Dice coefficient (DC), average percent volume error (AVE) and average absolute volume error (AAVE) were used to compare the computed GTV results with the experts' manual results.

RESULTS

The average DC, AVE and AAVE on test data are 0.79±0.05, -0.09±0.21, and 0.19±0.13, respectively. Comparing to 1-2 hours by the readers, our deep learning delineation takes less than 15 seconds per case.

CONCLUSION

Our results demonstrated the feasibility of deep learning approach for automatic GTV delineation of NPC during intensity modulated radiotherapy. Our automatic tool achieves good delineation quality on NPC GTV and greatly reduces the delineation time by hundred times compared to clinical doctors.

CLINICAL RELEVANCE/APPLICATION

Radiotherapy is one of the efficient routine treatment for NPC and accurate delineation of GTV is a key step in radiotherapy. Our automatic tool has potential to reduce the variability between human readers as well as improve the efficiency of the whole procedure.

MSRO23-03 Using Artificial Intelligence to Predict Oropharyngeal Cancer Recurrence After Radiation Therapy

Monday, Nov. 26 1:50PM - 2:00PM Room: E450A

Participants
William Su, New York, NY (*Presenter*) Nothing to Disclose
Martin Kang, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Yading Yuan, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Richard L. Bakst, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

richard.bakst@mountsinai.org

PURPOSE

HPV derived oropharyngeal cancers are less aggressive and more radiosensitive compared to non-HPV derived oropharyngeal cancers. In the HPV era, treatment de-escalation is one of the main areas of focus for clinical trials. However, recurrences still occur in HPV derived disease and can follow unique patterns, so it is important to identify patients at high risk of recurrence and ensure that they do not receive de-intensified treatment. Artificial intelligence can be used to analyze radiomic signatures and potentially predict recurrence. This would allow for personalized treatment planning based on radiographic risk profiles. Our purpose was to demonstrate that deep learning models have the potential to assess radiographic risk factors for oropharyngeal cancer recurrence.

METHOD AND MATERIALS

Radiotherapy planning CT scans of 108 patients with histologically proven oropharyngeal cancer were acquired from the TCIA Head-Neck-PET-CT collection. In this collection, all patients with recurrent cancer or metastases at presentation were excluded. Of 108 cases, 44 had loco-regional or distant recurrence of cancer after definitive radiation treatment. For each patient, a volume of interest (VOI) that embraces the Gross Tumor Volume was extracted from the entire CT scan. After being preprocessed for dimension standardization and intensity normalization, the VOI was input into a VGG16 based neural network to obtain a discriminative score, which indicates an estimate of the probability of recurrence of that tumor. Receiver Operating Characteristic (ROC) analysis was used to evaluate the classification performance of the VGG-based model.

RESULTS

By using 4-fold cross validation, the VGG-based classification model achieved an average accuracy of 0.59 and AUC of 0.60.

CONCLUSION

Our study shows that deep learning models have potential in predicting oropharyngeal cancer recurrence. This can eventually pave the way towards individualized radiation dosage planning based on radiomic signatures. A larger, multi-institutional dataset is required to further validate the model for clinical application.

CLINICAL RELEVANCE/APPLICATION

Artificial intelligence can be used to analyze radiographic features on CT simulation scans to predict recurrence risk and tailor radiation dosages in the HPV era of oropharyngeal cancers.

MSRO23-04 A Phase II, Proof-of-Concept Clinical Study of an Oral Mouth Rinse Containing Sandalwood Oil (SAO) for the Prevention of Oral and Oropharyngeal Mucositis Associated with (Chemo-) Radiation Therapy in Head and Neck Cancer Patients

Monday, Nov. 26 2:00PM - 2:10PM Room: E450A

Participants
Chul S. Ha, MD, San Antonio, TX (*Presenter*) Investigator, Santalis Pharmaceuticals, Inc
Ying Li, MD, San Antonio, TX (*Abstract Co-Author*) Investigator, Santalis Pharmaceuticals, Inc
Carol Jenkins, RN,MS, San Antonio, TX (*Abstract Co-Author*) Nothing to Disclose
Corey Levenson, PhD, San Antonio, TX (*Abstract Co-Author*) Officer, Santalis Pharmaceuticals

PURPOSE

Mucositis is one of the most debilitating side effects in patients treated with (chemo-) radiation therapy for head and neck cancer. This study was intended to evaluate the efficacy in alleviating mucositis, safety and tolerability of SAO (0.25% aqueous solution of an anti-inflammatory and anti-microbial essential oil from Santalum album trees).

METHOD AND MATERIALS

Patients to be treated with (chemo-) radiation therapy (>= 60 Gy) for cancers of oral cavity/oropharynx were asked to swish and gargle for 30 seconds, and spit, with 15 ml of the SAO three times a day throughout the radiation therapy. Pain in the oral cavity/oropharynx was measured using the numerical rating pain scale (NRPS) and mucositis was graded using the RTOG scale every week. Our data were compared with historical data in table 2 (incidence of mucositis), figure 1 (mean mucositis grade) and figure 2 (mean oral pain grade) from MD Anderson Cancer Center (MDACC) (doi:10.1016/j.ijrobp.2007.01.053) and table 4 (incidence of mucositis) from Memorial Sloan Kettering Cancer Center (MSKCC) (doi:10.1016/j.ijrobp.2010.10.041).

RESULTS

Fourteen subjects were enrolled but 6 withdrew (4 of them due to taste/smell of the rinse, 1 due to fatigue, 1 due to perceived ineffectiveness of the rinse). Among the 8 who completed the course of SAO treatment, 6 were treated with chemo-radiation and 2 with radiation only. IMRT was used for everyone. The median dose was 6,996 cGy in 33 fractions. There were no serious adverse events from SAO. The mean RTOG mucositis grades from weeks 3,6 and 9 were 1.125, 2.125 and 1.875. Two of 8 patients experienced mucositis >= 3. The corresponding mean NRPS were 3.700, 4.988 and 3.875.

CONCLUSION

The incidence of mucositis >= 3 were 70% from MDACC and 22% from MSKCC. Distribution of our mean NRPS and RTOG mucositis data compared favorably against figures 1 and 2 from MDACC. Though SAO was difficult to use due to poor taste/smell, it was otherwise well tolerated and appears to have enough signal to warrant further development as a potential alleviator of mucositis.

CLINICAL RELEVANCE/APPLICATION

This is a proof-of-concept clinical trial for an oral mouth rinse containing Sandalwood Oil for the prevention of mucositis associated with (chemo-) radiation therapy in head and neck cancer patients. We believe our results have generated enough signal to pursue further development of this preparation.

MSRO23-05 Locoregional Patterns of Failure (POF) following Therapeutic Dose Neck Radiation Therapy (RT) for Un-Resected Anaplastic Thyroid Cancer (ATC)

Monday, Nov. 26 2:10PM - 2:20PM Room: E450A

Awards
Student Travel Stipend Award

Participants
Amit Jethanandani, MPH, Houston, TX (*Presenter*) Nothing to Disclose
Mona K. Jomaa, MD,PhD, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose
Maria E. Cabanillas, Houston, TX (*Abstract Co-Author*) Research funded, Exelixis, Inc
Abdallah S. Mohamed, MD, MSc, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Renata Ferrarotto, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

Mark Zafereo, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Adam S. Garden, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
William H. Morrison, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Heath Skinner, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
S. J. Frank, MD, Houston, TX (*Abstract Co-Author*) Board Member, C4 Imaging LLC Stockholder, C4 Imaging LLC Advisory Board, Elekta AB
Jack Phan, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Jay Reddy, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
David I. Rosenthal, Houston, TX (*Abstract Co-Author*) Advisory Board, Bristol-Myers Squibb Company Advisory Board, Merck KGaA Research support, Merck KGaA
Clifton D. Fuller, MD,PhD, Houston, TX (*Abstract Co-Author*) Research Consultant, Elekta AB; Research Grant, Elekta AB; Speaker, Elekta AB
Brandon Gunn, MD, Galveston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Despite aggressive therapy, patients (pts) with ATC often develop locoregional progression (LRP). We aimed to identify the pattern of LRP in pts with un-resected ATC who received therapeutic doses of neck RT (>45 Gy).

METHOD AND MATERIALS

An institutional ATC database was retrospectively reviewed for pts who received neck RT from 01/00-08/17. ATC pts with un-resected disease were eligible if they received RT > 45 Gy at our institution and had follow-up CTs to assess for LRP. Progressive gross tumor volumes (rGTVs) were segmented on diagnostic CTs that demonstrated LRP (rCTs) and were reviewed by a head and neck radiation oncologist. rCTs were co-registered with treatment planning CTs (pCTs) using deformable image registration (VelocityAI 3.0.1). rGTVs were compared to original RT plans using a centroid-based approach. Failures were classified into 5 types based on pre-defined spatial/dosimetric criteria; A (central high dose), B (central elective dose), C (peripheral high dose), D (peripheral elective dose), and E (extraneous dose).

RESULTS

129 ATC pts received neck RT; of these, 103 had available plans and only 73 had plans and follow-up CTs. Of the 73, pts were excluded for prior resection (n=37) or if RT dose was $\leq$ 45 Gy (n=17). Thus, 19 formed the cohort. Most (79%) were Caucasian; median age was 63.5 years; 58% were stage IVC; 95% received IMRT; and all received systemic therapy. Median RT dose was 66 Gy (IQR: 59-66); median dose per fraction was 2 Gy (IQR: 1.7-2.2). Median follow-up was 7.9 mos. Six pts (31.5%) developed LRP and 16 rGTVs were identified (6 in 1 pt, 4 in 1, 3 in 1, and 1 in 3 each). Median time to LRP was 2.3 mos (range: 0-43). Of rGTVs, 7 were local (thyroid bed) and 9 were regional (1 in the paratracheal region; 1 in base of tongue [BOT]; 3 in node levels IIa; 1 in III; 2 in IV; and 1 in paraspinal musculature [PSM]). Type A was the most common rGTV POF (56%), followed by Types E (31%; 3 nodal, 1 BOT, and 1 PSM), B and C (8% each). Actuarial locoregional control (LRC) was 73% at 6 and 12 mos. Four living patients without LRP had a median follow-up of 27.5 mos (range: 9.3-65).

CONCLUSION

The identified POF was largely Type A and rapid (<6 mos), suggestive of a radiation resistance profile.

CLINICAL RELEVANCE/APPLICATION

Rapid neck progression was avoided in most ATC pts and some exhibited durable neck control, which could allow pts to receive subsequent systemic or targeted therapies.

MSRO23-06 A Population-Based Study of the Effects of Therapy, Primary Tumor Characteristics, and Metastatic Disease Sites on Survival in Patients with Metastatic Head and Neck Cancer

Monday, Nov. 26 2:20PM - 2:30PM Room: E450A

Awards
Student Travel Stipend Award

Participants
Justin Budnik, MD, Rochester, NY (*Presenter*) Nothing to Disclose
Nicholas J. Denunzio, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael T. Milano, MD, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Deepinder Singh, MD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Data is emerging that multimodality therapy (MMT) may improve overall survival (OS) in patients with metastatic head and neck cancer (M1-HNC). We aim to investigate the effects of MMT, tumor characteristics, and sites of metastatic disease on OS in M1-HNC patients using the Surveillance, Epidemiology, and End Results (SEER) database.

METHOD AND MATERIALS

2,827 patients from the SEER 18 registry diagnosed with M1-HNC from 2010-2014 were analyzed. Patients coded as having metastatic disease in bone, brain, liver, and lung were identified. Kaplan-Meier analyses and Cox proportional hazards models were used to assess the impact of MMT, primary tumor characteristics, and metastatic disease sites on OS.

RESULTS

Most patients were male (n=2,169, 76.7%), and had squamous carcinoma histology (n=2,009, 71.1%). Median age was 60 years and median OS was 10 months. Oropharynx (n=900, 31.8%) was the most common primary site. Patients coded as having metastases in lung and not in bone, brain, or liver (n=958, 33.9%) were the most common metastatic disease category. 518 patients (18.3%) received cancer-directed surgery (CDS), 1,458 patients (51.6%) received radiation (RT), and 1,690 patients (59.8%) received chemotherapy (CT). 579 patients (20.5%) received neither CDS, nor RT, nor CT (no therapy-group). With Cox regression accounting for age, sex, race, primary site, histology, grade, T stage, N stage, and metastatic sites, those who received CDS, RT, and CT (n=172, 6.1%) had the largest OS benefit (HR=0.22, 95% CI 0.17-0.28, p<0.001) compared to the no therapy-group. Patients receiving RT and CT were the most common MMT combination (n=879, 31.1%), and had improved OS (HR=0.35,

95% CI 0.30-0.40, p<0.001) compared to the no therapy-group. Primary and metastatic disease site-specific analyses showed that MMT combinations provided and OS benefit at all primary sites in the head and neck region and across metastatic sites with the exception of those coded as having metastases in bone and lung, and not in brain and liver.

CONCLUSION

In this hypothesis-generating study MMT is associated with improved OS in patients with M1-HNC. The OS benefit persists across primary and metastatic disease sites. Prospective study of MMT in M1-HNC patients is warranted.

CLINICAL RELEVANCE/APPLICATION

In this population-based, hypothesis-generating study multimodality therapy is associated with improved overall survival in patients with metastatic head and neck cancer.

MSRO27

BOOST: Breast-Science Session with Keynote

Monday, Nov. 26 1:30PM - 2:30PM Room: S103CD

BR RO OI

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Kathleen Horst, MD, Stanford, CA (*Moderator*) Nothing to Disclose
Anna Shapiro, MD, Syracuse, NY (*Moderator*) Nothing to Disclose

Sub-Events

MSRO27-01 Invited Speaker:

Monday, Nov. 26 1:30PM - 1:50PM Room: S103CD

Participants
Jianling Yuan, MD, PhD, Minneapolis, MN (*Presenter*) Nothing to Disclose

MSRO27-03 Where Are the RCTs? Analysis of the 2018 American Society for Radiation Oncology (ASTRO) Evidence-Based Guidelines for Radiation Therapy to the Whole Breast as Treatment for Breast Cancer

Monday, Nov. 26 1:50PM - 2:00PM Room: S103CD

Participants
Norman R. Williams, PhD, London, United Kingdom (*Presenter*) Travel support, Carl Zeiss AG

For information about this presentation, contact:

norman.williams@ucl.ac.uk

PURPOSE

Early in 2018, the American Society for Radiation Oncology (ASTRO) produced evidence-based guidelines on five key questions for radiation therapy to the whole breast as treatment for breast cancer [Smith et al PMID: 29545124]. An analysis was made of the publications supporting these guidelines to determine how many reported level-1 evidence from randomised clinical trials (RCTs), as this is the standard applied to chemotherapy and adjuvant hormonal therapy.

METHOD AND MATERIALS

All 112 references were scrutinized, and tabulated according to level of evidence (RCT or not), year of publication, country of lead author, and which of the statements (grouped into five key questions) they addressed.

RESULTS

Of the 33 statements, 12 are not supported by evidence from RCTs. In a further 9 statements, data from RCTs only partly support the consensus. Therefore, 21/33 (64%) of the statements are not directly supported by evidence from RCTs. There is no evidence from RCTs to support any of the statements regarding avoiding exposure of cardiac and other normal tissue (key questions 4 and 5). Such exposure has been linked to death from ischemic heart disease [Darby et al PMID: 23484825] and lung cancer [Taylor et al PMID: 28319436]. There is evidence that the effects of a course of whole breast radiation therapy induces early ECG changes [Tuohinen et al PMID: 29599341]; biological effects can be detected after a single fraction [Woolf et al PMID: 25045612]. Such measures could be used in the design of RCTs, particularly of patients with low-risk breast cancer in whom de-escalation of breast radiation therapy (using accelerated partial breast, intra-operative, etc.) may be warranted to reduce an imbalance in the efficacy/safety profile [Franco et al PMID: 29616366].

CONCLUSION

The majority of the 2018 ASTRO evidence-based guidelines for use of radiation therapy in breast cancer are not based on level-1 evidence from RCTs. Trials using techniques that minimize exposure to normal tissues are urgently required.

CLINICAL RELEVANCE/APPLICATION

Clinicians and patients should be aware that current guidelines for treatment of breast cancer using radiation therapy are mostly based on sub-optimal evidence.

MSRO27-04 Clinical Outcomes and Toxicity of Proton Beam Radiation Therapy for Re-Irradiation of Locally Recurrent Breast Cancer

Monday, Nov. 26 2:00PM - 2:10PM Room: S103CD

Awards
Student Travel Stipend Award

Participants

Prashant Gabani, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Maria A. Thomas, MD, PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Beth Bottani, CMD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Jeffrey D. Bradley, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Laura Ochoa, RN,PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Imran Zoberi, MD, St. Louis, MO (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

pgabani@wustl.edu

PURPOSE

Repeat radiation therapy (RT) using x-rays for locally recurrent breast cancer results in increased short and long-term toxicity. Proton beam RT (PBRT) can minimize dose to surrounding organs thereby reducing toxicity. Here, we report the toxicity and outcomes for women who underwent re-irradiation to the chest wall for locally recurrent breast cancer using PBRT.

METHOD AND MATERIALS

A total of 16 patients with locally recurrent breast cancer who underwent re-irradiation to the chest wall with PBRT between 2014-2018 were retrospectively analyzed. For their recurrences, 6 patients underwent salvage mastectomy, 8 patients had wide local excision, and 2 patients had biopsy only. The median dose for the first RT course was 50 Gy, and for the second course, 50.4 Cobalt Gy Equivalent. The target for re-irradiation was chest wall alone in 12 patients and chest wall plus regional nodes in 4 patients. A boost was delivered in 3 (18.8%) patients. Concurrent hyperthermia was used in 10 (62.5%) patients. For systemic therapy, 4 (25%) patients received chemotherapy and 8 (50%) patients received hormone therapy. Follow up was calculated from the start of second RT course. Toxicities were based on CTCAE 4.0.

RESULTS

The median age at diagnosis and at recurrence was 49.8 years and 60.2 years respectively. The median time between the two RT courses was 10.2 (0.7-20.2) years. The median follow up time was 10.6 (1.5-29.1) months. There were no local failures observed after re-irradiation. Only one patient developed distant metastasis and ultimately died. Grade 3-4 acute skin toxicity was observed in 5 (31.2%) patients. There were 4 (25%) patients who developed chest wall infections during or shortly (2 weeks) after re-irradiation. Grade 3-4 fibrosis was observed in only 3 (18.8%) patients. Grade 5 toxicities were not observed. Hyperpigmentation was seen in 12 (75%) patients. Other RT related toxicities such as pneumonitis, telangiectasia, rib fracture, and lymphedema occurred in 2 (12.5%), 4 (25%), 1 (6.3%), and 1 (6.3%) patients respectively.

CONCLUSION

Re-irradiation with PBRT for recurrent breast cancer has acceptable toxicities. There was a high incidence of grade 3-4 skin toxicity and infections, however, they resolved with skin care and antibiotics. Further follow up is needed to determine long-term clinical outcomes.

CLINICAL RELEVANCE/APPLICATION

PBRT can be safely used for re-irradiation of the chest wall for locally recurrent breast cancer.

MSRO27-05 Carcinosarcoma of the Breast: Treatment Patterns and Survival Outcomes

Monday, Nov. 26 2:10PM - 2:20PM Room: S103CD

Awards
Trainee Research Prize - Resident

Participants
William R. Kennedy, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Prashant Gabani, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Sahaja Acharya, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Maria A. Thomas, MD, PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Imran Zoberi, MD, St. Louis, MO (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Carcinosarcoma of the breast is a rare yet highly-aggressive tumor accounting for less than 1% of all breast cancers, for which guidance on optimal management and prognosis are sparse. The purpose of this study is to investigate population-based treatment patterns and overall survival (OS) outcomes in patients with this diagnosis.

METHOD AND MATERIALS

We queried the National Cancer Database for patients diagnosed with carcinosarcoma (Histology 8980) of the breast. All patients included were treated with surgery, with or without chemotherapy and/or radiation therapy. Patients with metastatic disease were excluded. Kaplan-Meier analysis was used to estimate OS. Univariate and multivariate cox analyses were used to determine predictive factors of OS.

RESULTS

A total of 329 patients from 2004-2012 were identified. Median age at diagnosis was 58 years (range, 24-90). Patients had T1 (21%), T2 (44%), T3 (25%), or T4 disease (10%). Most patients were node-negative at diagnosis (77%). Breast conservation surgery was utilized in 33% of patients. Chemotherapy was used in 66% of patients. Less than half (44%) of patients received radiation therapy to a median dose of 50.4Gy (range 35-56 Gy), with a median 10Gy boost used in 76%. With median follow-up of 39.9 months, 3-year overall survival was 74%. Multivariate analysis revealed that T-stage, margin status, and chemotherapy use all significantly influenced OS. There was a trend towards improved survival with the use of RT (HR 0.66, 95% CI 0.43-1.01, p =0.053). The 3-yr OS was 80% in patients receiving chemotherapy vs 59% without chemotherapy. The 3-yr OS was 82% in patients receiving RT vs 66% without RT.

CONCLUSION

Carcinosarcoma of the breast is associated with relatively poor rates of OS. The use of chemotherapy was associated with improved OS, with a trend towards improved OS with the use of RT.

CLINICAL RELEVANCE/APPLICATION

In the largest study to date investigating outcomes in carcinosarcoma of the breast, adding chemotherapy to surgery improved OS. A trend toward improved OS was also seen with adjuvant RT.

MSRO27-06 Quantitative Ultrasound Characterization of Radiation-Induced Acute Skin Toxicity in Breast Cancer Patients Receiving Radiation Therapy: A Feasibility Study

Monday, Nov. 26 2:20PM - 2:30PM Room: S103CD

Participants
Sylvia D. Tang, Johns Creek, GA (*Presenter*) Nothing to Disclose
Jiwoong Jason Jeong, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Xiaofeng Yang, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Mylin A. Torres, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Arif N. Ali, MD, MS, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Tian Liu, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Despite technological advances in radiotherapy, high dose of radiation may induce acute skin toxicity in the majority of women receiving breast-cancer radiotherapy. In current clinical practice, the severity of skin toxicity is often rated by clinicians through visual inspection and physics examination, which is subjective. The purpose of this study is to investigate the feasibility of quantitative characterization of radiation-induced acute skin toxicity via ultrasound morphological and texture analysis.

METHOD AND MATERIALS

Twelve patients receiving standard breast radiotherapy were enrolled in the longitudinal ultrasound study. Ultrasound B-mode images are acquired at various time points: prior to, weekly during, as well as 6 weeks and 3 months post radiotherapy. At each time point, 4 images (12, 3, 6 and 9 o'clock) were acquired on the irradiated breast and 4 mirror images were acquitted on the contralateral normal breast. To evaluate radiation-induced skin changes, we performed both morphological (area, height, perimeter and averaged skin thickness) and textural (contrast, angular second moment (ASM) and inverse difference moment (IDM)) analyses using ImageJ. Clinical assessment of skin toxicity was performed at each time point.

RESULTS

Changes in skin thickness and texture were observed in 5 patients as early as 1 week during treatment. In 2 cases with most severe acute toxicity, the average skin thickness of irradiated breast increases more than 175% and 188% at the end of fractionated therapy in comparison to the untreated contralateral breast, while their slopes in linear regression are 0.87 and 0.70, respectively. Acute skin toxicity was observed in differences in 5 cases in the angular second moment measurements and in 4 cases of entropy analysis over the patient's temporal treatment course.

CONCLUSION

Radiation-induced skin toxicity in breast cancer patients can be quantitatively assessed by ultrasound-based morphologic and textural characterization.

CLINICAL RELEVANCE/APPLICATION

Quantitative ultrasound characterization of radiation-induced acute skin toxicity in breast cancer patients receiving radiation therapy may be of clinical relevance for the optimization of treatment protocols and potential early intervention to prevent long-term breast toxicity.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

SPPH21

Basic Physics Lecture for the RT: Dual Energy CT Applications in Radiation Therapy

Monday, Nov. 26 1:30PM - 2:45PM Room: S402AB

CT PH RO

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants
Scott J. Emerson, MS, Royal Oak, MI (*Moderator*) Nothing to Disclose
Jessica Miller, PhD, Madison, WI (*Presenter*) Research Grant, Siemens AG

For information about this presentation, contact:

scott.emerson@beaumont.org

LEARNING OBJECTIVES

1) Explain basic dual-energy CT principles. 2) Compare current dual-energy CT techniques and associated limitations. 3) Identify dual-energy CT applications in radiation therapy.

ABSTRACT

Nearly all patients treated with radiation therapy receive a computed tomography (CT) simulation scan for treatment planning purposes. Dual-energy CT (DECT) allows for the reconstruction of supplementary information during the CT simulation process, such as relative electron density and effective atomic number information, virtual monoenergetic images, and the differentiation of materials. The additional information gained through DECT has potential to aid in several aspects of the radiation therapy process. This course will outline the basic principles of DECT and compare different vendor solutions for acquisition of DECT images. DECT applications for radiation therapy will be discussed, including improving dose calculation accuracy, improving tumor and healthy tissue delineation, characterizing treatment response, and identifying and sparing functional healthy tissue.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

MSRO24

BOOST: Head and Neck-Case-based Multidisciplinary Review (Interactive Session)

Monday, Nov. 26 3:00PM - 4:15PM Room: E450A

HN NR OI RO

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants
Suresh K. Mukherji, MD, Northville, MI (*Presenter*) Nothing to Disclose
Sung Kim, MD, New Brunswick, NJ (*Presenter*) Nothing to Disclose
Francis P. Worden, MD, Ann Arbor, MI (*Presenter*) Grant, Bayer AG; Grant, Eisai Co, Ltd; Grant, AstraZeneca PLC; Grant, IRX Therapeutics; Grant, Galera Therapeutics; Grant, Bristol-Myers Squibb Company; Grant, Merck & Co, Inc; Consultant, Merck & Co, Inc
Chad Zender, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the imaging findings of various head and neck neoplasms in the post treatment setting. 2) Discuss the benefits of various imaging modalities and the scenarios they are most useful in the post treatment setting. 3) Identify imaging findings that change treatment and management.

ABSTRACT

This formal is a multidisciplinary tumor board which will dsicuss a varity of head and neck tumors. The participants will be a Head & Neck surgeon, Radiation Oncologist, Medical Oncologist and Head & Neck Radiologist. The emphasis will be on developing a better understanding of how various imaging modalities can be used in the post treatment setting to differentiate benign post treatment radiographic changes from those that are more concerning for recurrence.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

MSRO28

BOOST: Breast-Case-based Multidisciplinary Review (Interactive Session)

Monday, Nov. 26 3:00PM - 4:15PM Room: S103CD

BR OI RO

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants
Nora M. Hansen, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Bethany L. Niell, MD,PhD, Tampa, FL (*Presenter*) Nothing to Disclose
Jean L. Wright, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Cesar A. Santa-Maria, MD, Baltimore, MD (*Presenter*) Research funded, AstraZeneca PLC; Research funded, Pfizer Inc; Advisory Board, Polyphor

For information about this presentation, contact:

jwrigh71@jhmi.edu

LEARNING OBJECTIVES

1) Describe the latest advances in breast cancer imaging before, during, and after treatment. 2) Facilitate a multidisciplinary approach to the diagnosis, management, and treatment of breast cancer.

SSE25

Science Session with Keynote: Radiation Oncology (Gynecologic Cancers)

Monday, Nov. 26 3:00PM - 4:00PM Room: S104B

MR OI RO

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Tracy M. Sherertz, MD, San Francisco, CA (*Moderator*) Nothing to Disclose
Jianling Yuan, MD, PhD, Minneapolis, MN (*Moderator*) Nothing to Disclose

Sub-Events

SSE25-03 The Value of K-trans in DCE-MRI in the Diagnosis of Pathological Grade of Cervical Cancer

Monday, Nov. 26 3:20PM - 3:30PM Room: S104B

Participants
Miao Niu, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Ailian Liu, MD, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Shifeng Tian, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Wang Nan, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Ying Zhao Jr, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Yue Lv, Dalian, China (*Presenter*) Nothing to Disclose

PURPOSE

The value of Ktrans in DCE-MRI in the diagnosis of pathological grade of cervical cancer

METHOD AND MATERIALS

Retrospective analysis of 19 patients with poorly differentiated and 15 moderately well-differentiated cervical cancers who were confirmed by surgery and pathology from September 2015 to February 2017 and preoperatively performed 1.5T MRT1WI, T2WI, DCE-MRI, DWI, and other MR examinations. DCE-MRI images were analyzed and measured by two observers using the GenIQ software on the ADW4.6 workstation. The consistency of the data was evaluated by using ICC. An independent sample t test was used to compare the difference in Ktrans values in DCE-MRI between poorly differentiated and moderately differentiated cervical cancers. The ROC curve was used to analyze the Ktrans value to identify the diagnostic efficiency of poorly differentiated and moderately differentiated.

RESULTS

The parameters measured by the two observers were in good agreement (ICC values >0.75). The Ktrans value of the poorly differentiated group was greater than the moderately high differentiated group (0.70±0.21 vs 0.52±0.20), and the difference was statistically significant (P<0.05). The Ktrans value >=0.68 is a diagnostic threshold for the diagnosis of poorly differentiated and moderately differentiated, corresponding sensitivity and specificity of 52.6% and 81.2%, and AUC is 0.717.

CONCLUSION

The value of Ktrans in DCE-MRI has a certain value in the differential diagnosis of poorly differentiated and moderately differentiated cervical cancer.

CLINICAL RELEVANCE/APPLICATION

The prognosis of poorly differentiated and moderately differentiated cervical cancer is completely different, and differential diagnosis is extremely important.

SSE25-04 Radiologic Assessment of Inguinal Lymph Nodes in Pelvic Malignancies

Monday, Nov. 26 3:30PM - 3:40PM Room: S104B

Awards
Student Travel Stipend Award

Participants
Soumon Rudra, MD, St. Louis, MO (*Presenter*) Nothing to Disclose
Dominique Fuser, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Margery Gang, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Caressa Hui, BS, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Yuan J. Rao, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Todd DeWees, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Julie K. Schwarz, MD, PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Perry W. Grigsby, MD, Saint Louis, MO (*Abstract Co-Author*) Speaker, Siemens AG

Delphine L. Chen, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Stephanie Markovina, MD, PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

smarkovina@wustl.edu

PURPOSE

Metastatic involvement of inguinal lymph nodes can alter radiation therapy (RT) planning for pelvic tumors. 18F-FDG PET/CT can identify metastatic nodes; however, inguinal nodes are commonly abnormal due to non-malignant processes such as infection or inflammation, complicating interpretation. We evaluated quantitative PET metrics to improve identification of metastatic inguinal nodes in patients with pelvic tumors compared to standard clinical interpretation.

METHOD AND MATERIALS

We identified 36 patients with vulvar cancer, 4 with vaginal cancer, and 14 with anal cancer who underwent 18F-FDG PET/CT prior to pathologic evaluation of inguinal nodes. For each groin evaluated pathologically, we analyzed the following values on the node with highest FDG uptake: maximum, peak and mean standardized uptake values (SUVmax, SUVpeak, SUVmean, respectively), total lesion glycolysis (TLG) and metabolic tumor volume (MTV). SUVmean, TLG and MTV were determined for volumes defined by thresholds of 42% and 50% of SUVmax, and for SUV >= 2.5. CT images were used to measure volume, short and long axes of each lymph node. Multivariate logistic regression identified predictive metrics for pathologic positive nodes and generated a probabilistic model. The AUCs of ROC curves for the model were compared to the standard clinical interpretation from the diagnostic report using adjacent pairwise differences.

RESULTS

Of 54 patients identified, 75 groins were evaluated pathologically resulting in 75 nodes for analysis (35 were positive for malignancy). Logistic regression identified SUVmean (50% threshold) and short axis length as most predictive for metastatic nodes. The model was better able to predict pathologic involvement compared to standard clinical interpretation (AUC: 0.91 [95%CI: 0.84 - 0.97] vs 0.80 [95%CI: 0.71 - 0.90], P<0.01).

CONCLUSION

18F-FDG PET/CT diagnostic accuracy for metastatic inguinal nodes in pelvic tumors may be improved with use of quantitative PET metrics and warrants further validation. Improving prediction of metastatic nodes can aid with appropriate selection of patients for pathologic node evaluation and guide RT volumes and doses.

CLINICAL RELEVANCE/APPLICATION

18F-FDG PET/CT accuracy for inguinal metastases may be improved with quantitative metrics for patients with pelvic malignancies and aid with radiation treatment planning.

SSE25-05 Assessment of MR Compatibility of Novel Needle Placement Template and Collets for Intraperitoneal Interstitial Gynecological Brachytherapy Application

Monday, Nov. 26 3:40PM - 3:50PM Room: S104B

Participants
Christopher J. Tien, PhD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Marie Hausner, RT, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Zhe Chen, PhD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Matthew Hoerner, PhD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Holly Lincoln, MS, New Haven, CT (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

christopher.tien@yale.edu

PURPOSE

A supplemental template kit was obtained to aid intraperitoneal needle implant geometry for MR-guided interstitial cervical brachytherapy. This product is in final stages of FDA approval and has not yet received MR-conditional designation. Therefore, our institution independently evaluated the MR compatibility using ASTM International guidelines and report our results.

METHOD AND MATERIALS

The supplemental kit consisted of the template (made of PEEK material with 40 6-Fr diameter holes) and 25 titanium collets. In the proposed clinical kit, the template and collets would be added to existing equipment including the cylindrical obdurator, tandem, and PEEK needles, which have been deemed MR-conditional previously. The planned fully-assembled applicator set is shown in Figure 1. A 3.0 T magnet was used to represent the most challenging MR environment as our institutional policy for MR-guided treatment planning is 1.5 T. Magnetically-induced effects of displacement force and torque were evaluated using ASTM F2052-15 and F2213-06 standard test methods, respectively. RadioFrequency (RF)-induced heating was evaluated using ASTM F2182-11a standard test methods. Final assessment for MR-conditional status was defined using ASTM F2503 requirements.

RESULTS

For the template and collets, the mean measured displacement was undetectable, there was no observed translation, no observed deflection, and no observed torque when placed at the strongest point of the magnet. Neither template nor collets were deemed candidates for RF-induced heating. The template was exempted based on its composition of 100% PEEK material. The collets were exempted as literature has repeatedly shown that devices smaller than one-tenth of the electromagnetic field (i.e. 5 cm for 1.5 T and 2.4 cm for 3.0 T) will not have a measurable rise in temperature.

CONCLUSION

ASTM International standards and guidelines were newly-acquired equipment. Standard test methods showed absence of any movement or torque, and complied with exemptions for RF-induced heating tests. Following ASTM F2503 guidelines, the equipment

is MR-conditional for 3 T, and thus is MR-conditional for 1.5 T.

CLINICAL RELEVANCE/APPLICATION

Novel brachytherapy applicator designed for MR-guided radiation therapy was tested internally by our institution to ensure MR compatibility and was deemed MR-conditional.

SSE25-06 3D MRI-Based Brachytherapy for Cervical Cancer: Can Dose Escalation Improve Survival?

Monday, Nov. 26 3:50PM - 4:00PM Room: S104B

Awards
Student Travel Stipend Award

Participants
Zachary D. Horne, MD, Pittsburgh, PA (*Presenter*) Nothing to Disclose
Ronny Kalash, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Sushil Beriwal, MD, Wexford, PA (*Abstract Co-Author*) Consultant, Varian Medical Systems, Inc

PURPOSE

Brachytherapy is an essential component of the treatment of locally advanced cervical cancer; recent GEC-ESTRO guidelines recommend that the dose to 90% (D90) of the high-risk clinical target volume (HRCTV) be at least 85Gy with even higher doses recommended to improve outcomes

METHOD AND MATERIALS

A retrospective review of brachytherapy plans delivered at a single institution were evaluated for dose parameters and local control following treatment. The HRCTV D90 was retrieved from all plans. Survival was defined as the interval between last brachytherapy fraction to time of death or last follow up. Significance of tumor parameters on survival was evaluated with uni- and multivariable Cox regression analysis.

RESULTS

A total of 250 women underwent high dose-rate brachytherapy for cervical cancer between 2007 and 2017 with evaluable dosimetry. Median follow up was 27.5 months. The median prescribed dose was 27.5Gy/5fx with a median HRCTV D90 of 83.9Gy (IQR: 81.9-85.7Gy), HRCTV volume of 31cc (IQR: 25.9-39.9cc), and treatment time of 7.3 weeks. Overall survival at 2 and 5 years was 84.9% and 72.4%. Factors which correlated with survival included age, initial tumor size, HRCTV D90, treatment time and HRCTV volume. On multivariable analysis, only HRCTV volume (HR 1.039 [95%CI 1.017-1.062], p=0.001), prolonged treatment time (HR 1.439 [HR 1.176-1.762], p<0.001), initial tumor size (HR 1.184 [95%CI 1.010-1.389], p=0.037), and age (HR 1.038 [95%CI 1.016-1.060], p<0.001) correlated with survival. HRCTV D90 approached significance with a higher D90 per Gy: HR 0.901 [95%CI 0.808-1.005], p=0.061. Survival at 2 and 5 years for women with tumors 31cc and less at the time of BT were 91.6% and 78.5% vs 78.3% and 66.0% for women with tumors greater than 31cc (p=0.026).

CONCLUSION

Survival is excellent with MRI-based planning in the entire cohort of patients. Our data suggests that adverse factors such as adenocarcinoma histology, large tumor, and poor response to chemoradiation cannot be overcome with dose escalation. The prospective EMBRACE II trial will further help us clarify the impact of dose escalation in poor responders.

CLINICAL RELEVANCE/APPLICATION

This suggests that different methods of therapeutic intervention are required for high-risk and poor-responding cervical cancer patients.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

MSRO29

BOOST: Head and Neck-eContouring

Monday, Nov. 26 4:30PM - 5:30PM Room: S104B

HN NR OI RO

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Suresh K. Mukherji, MD, Northville, MI (*Presenter*) Nothing to Disclose
Sung Kim, MD, New Brunswick, NJ (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Demonstrate how Radiation Oncologists contour head & necks prior to delivering radiation therapy. 2) Review the concepts of GTV, CTV & PTV. 3) Allow participants to contour the tumors and compare this with our experts.

ABSTRACT

This e-contouring session is an interactive session that allows the attendees to contour head and neck tumors and compare their results with the expert. We will also review the important of imaging for idenfying tumor mapping and tumor spread.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

MSRO31

BOOST: Gastrointestinal-Oncology Anatomy (Interactive Session)

Tuesday, Nov. 27 8:30AM - 10:00AM Room: S103AB

GI OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants

Zhen J. Wang, MD, Hillsborough, CA (*Presenter*) Stockholder, Nextrast, Inc
Mary U. Feng, MD, San Francisco, CA (*Presenter*) Self: Consultant, Varian, Inc and RefleXion Medical Inc; Spouse (Felix Feng, MD), Advisory Boards Dendreon, Janssen, Bayer, Sanofi, Ferring, EMD Serono, Medivation/Astellas, Blue Earth Diagnostics, Progenics; Spouse, honorarium Clovis
Edward Y. Kim, MD, Seattle, WA (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

Jane.Wang@ucsf.edu

Mary.feng@ucsf.edu

LEARNING OBJECTIVES

1) Describe relevant liver anatomy and key imaging features of liver tumors. 2) Describe new techniques for imaging liver tumors and monitoring treatment response.

MSRO35

BOOST: Lung-Oncology Anatomy (Interactive Session)

Tuesday, Nov. 27 8:30AM - 10:00AM Room: S103CD

CH OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Subba R. Digumarthy, MD, Boston, MA (*Presenter*) Nothing to Disclose
Amita Sharma, MBBS, Boston, MA (*Presenter*) Nothing to Disclose
Melin J. Khandekar, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

sdigumarthy@mgh.harvard.edu

LEARNING OBJECTIVES

1) Explain the different techniques and approaches for radiation therapy delivery. 2) Identify the anatomy relevant for thoracic oncology treatment planning. 3) Define targets and organs at risk for thoracic radiation therapy.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Subba R. Digumarthy, MD - 2013 Honored Educator

RC320

Role of MR Imaging in Cancer Staging and Treatment

Tuesday, Nov. 27 8:30AM - 10:00AM Room: S403B

BR GI MR RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Kathryn J. Fowler, MD, San Diego, CA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Overview of MRI use in cancer staging, treatment delivery, and response assessment. -Understand the imaging approach to staging rectal cancer -Review pertinent anatomy -Discuss reporting of stage -Understand response indicators and how to report

Sub-Events

RC320A Role of MR Imaging in GI Cancer Staging

Participants
Kathryn J. Fowler, MD, San Diego, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review basic MRI approach to staging gastrointestinal malignancies (pancreatic and rectal). 2) Understand the application of MR/imaging features for assessing response to therapy.

RC320B MR-guided Radiotherapy for GI Cancers

Participants
Michael F. Bassetti, MD, Madison, WI (*Presenter*) Research Grant, Merck KGaA; Research Grant, AstraZeneca PLC;

LEARNING OBJECTIVES

1) Identify the clinical sites where MR-guided radiation may have the highest impact. 2) Understand the unique sources of uncertainty of MR-guided radiation that differ from conventional LINAC radiation. 3) Identify the most common indications for on-line MR -guided adaptive radiotherapy observed in clinical practice.

RC320C Role of MR Imaging in Breast Cancer Staging

Participants
Bethany L. Niell, MD,PhD, Tampa, FL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify evidence-based indications for MR imaging in breast cancer staging. 2) Describe the frequencies of ipsilateral multifocal or multicentric disease and contralateral breast cancer detected on breast MRI. 3) Explain potential pitfalls and limitations of breast MRI performed for staging.

RC320D MR-guided Radiotherapy for Breast Cancer

Participants
Maria A. Thomas, MD, PhD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Michael F. Bassetti, MD, Madison, WI (*Presenter*) Research Grant, Merck KGaA; Research Grant, AstraZeneca PLC;

LEARNING OBJECTIVES

1) Identify potential applications of MR-guided radiotherapy for breast cancer. 2) Describe the advantages and disadvantages of MR-guided radiotherapy for breast cancer.

RC322

Functional MR Imaging for Normal Tissue Response Assessment in Radiotherapy

Tuesday, Nov. 27 8:30AM - 10:00AM Room: S104A

BQ MR PH RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Kristy K. Brock, PhD, Houston, TX (*Moderator*) License agreement, RaySearch Laboratories AB

Sub-Events

RC322A State of the Art in Functional MR Imaging for Normal Tissue Assessment

Participants
Kiaran P. McGee, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify underlying biological processes associated with functional magnetic resonance imaging techniques. 2) List most commonly used functional imaging techniques in magnetic resonance imaging. 3) Explain the physics of various functional magnetic resonance imaging technique described in the presentation.

RC322B Clinical Need for Functional MR Imaging for Normal Tissue Assessment in Radiation Therapy

Participants
Aaron J. Grossberg, MD, PhD, Portland, OR (*Presenter*) Nothing to Disclose

RC322C Technical Challenges in the Integration of Functional MR Imaging for Normal Tissue Assessment into Radiotherapy

Participants
Martha M. Matuszak, PhD, Ann Arbor, MI (*Presenter*) Research funded, Varian Medical Systems, Inc; Consultant, Varian Medical Systems, Inc

LEARNING OBJECTIVES

1. Discuss the challenges in incorporating functional MR into treatment planning

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

MSRO32

BOOST: Genitourinary Prostate (Interactive Session)

Tuesday, Nov. 27 10:30AM - 12:00PM Room: S103AB

GU OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Daniel A. Hamstra, MD, PhD, Dearborn, MI (*Presenter*) Consultant, Augmenix, Inc
Jonathan M. Willatt, MBChB, Ann Arbor, MI (*Moderator*) Nothing to Disclose
Tristan Barrett, MBBS, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose
Brian J. Davis, MD, PhD, Rochester, MN (*Presenter*) Stockholder, Pfizer Inc; Speaker, Augenix Inc
Arvin K. George, MD , Ann Arbor, MI (*Presenter*) Nothing to Disclose
Nicole Curci, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To develop an understanding of the multidisciplinary interactions involved in the selection of patients who should undergo multiparametric prostate MRI. 2) To define the imaging features of high grade prostate cancer on MRI. 3) To describe the process whereby patients are selected for active surveillance or treatment for high grade prostate cancer. 4) To appraise a selection of lesions for categorization under the PIRADS criteria and determine how they should be followed or treated.

ABSTRACT

Multiparametric MRI for prostate cancer is now the standard of care for patients with suspected prostate cancer. The introduction of the PIRADS 2 system has enabled us to standardise the care of prostate cancer patients. Diagnosis, active surveillance, biopsy and choice of either radical prostatectomy, radiation or locoregional therapy are included in the diagnostic and treatment alogrithms. We describe the imaging features on prostate MRI which determine whether a patient is suspected of having high grade prostate cancer. We define the treatment choices and, through a cased based presentation, present a selection of cases for decision making in a tumour board scenario.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

MSRO36

BOOST: Mediastinum and Pleura-Oncology Anatomy (Interactive Session)

Tuesday, Nov. 27 10:30AM - 12:00PM Room: S103CD

CH OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Meng X. Welliver, MD, Columbus, OH (*Presenter*) Nothing to Disclose
Mizuki Nishino, MD, MPH, Newton, MA (*Presenter*) Institutional Research Grant, Merck & Co, Inc; Institutional Research Grant, Canon Medical Systems Corporation; Institutional Research Grant, AstraZeneca PLC; Speaker, F. Hoffmann-La Roche Ltd; Consultant, DAIICHI SANKYO Group
Alexander Louie, MD, FRCPC, London, ON (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

mizuki_nishino@dfci.harvard.edu

alexander.louie@sunnybrook.ca

meng.welliver@osumc.edu

LEARNING OBJECTIVES

1) Describe the mediastinal and pleural anatomy on imaging for treatment planning and monitoring for thoracic malignancy with a focus on thymic tumors and mesothelioma. 2) Discuss the cutting-edge strategies and pitfalls for treatment planning and disease surveillance for thymic tumors and mesothelioma. 3) Understand the importance of multidisciplinary approaches to thoracic malignancy involving the mediastinum and pleura.

ABSTRACT

The purpose of this course is to provide attendees with a practical knowledge of the mediastinal and pleural anatomy and the understanding of the treatment planning strategies and pitfalls for thoracic malignancy with a focus on thymic tumors and mesothelioma, highlighting the importance of multidisciplinary approaches to these tumors.

SSG15

Radiation Oncology (CNS Malignancies)

Tuesday, Nov. 27 10:30AM - 12:00PM Room: S403B

BQ MR NR OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Hui-Kuo G. Shu, MD, PhD, Atlanta, GA (*Moderator*) Speakers Bureau, Varian Medical Systems, Inc; Stockholder, Medtronic plc; Stockholder, Apple Inc; Stockholder, ICON plc; Stockholder, Raytheon
Brent D. Weinberg, MD, PhD, Atlanta, GA (*Moderator*) Nothing to Disclose
Hyunsuk Shim, PhD, Atlanta, GA (*Moderator*) Nothing to Disclose

Sub-Events

SSG15-01 Decoding IDH Genotype in Grade-II and -III Gliomas Using Machine Learning with Protein-based Amide Proton Transfer-Weighted (APTw) and Magnetization Transfer (MT) MRI

Tuesday, Nov. 27 10:30AM - 10:40AM Room: S403B

Participants
Shanshan Jiang, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Jinyuan Zhou, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Qihong Rui, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Zhibowen Wen, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Hao Yu, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The 2016 WHO includes molecular markers, such as isocitrate dehydrogenase (IDH) mutation status, to classify diffuse gliomas. This reveals an unmet radiographic need-the ability to identify genetic biomarkers preoperatively, with methods such as MRI. This study aimed to evaluate the power of machine learning based on endogenous mobile protein-based APTw and semi-solid macromolecule-based MT MRI features in classifying IDH1/2 mutation status.

METHOD AND MATERIALS

105 patients with grade-II or -III gliomas with pre-operational routine and APTw MR images, and lab test reports of IDH mutation status were retrospectively recruited. 391 radiomics features were extracted from the tumor ROIs on APTw, MT, and structural MR images. The support vector machine (SVM) method was implemented (A). 70, 25 and 10 cases were randomly assigned to the training set, validation set, and test set. 10-fold cross-validation was used for tuning parameter (γ) selection. The dimensionality of all features is reduced using principal component analysis (PCA). Leave-one-out cross-validation was applied to estimate the classification performance of the models. The alpha level of all tests was set at $P < 0.05$.

RESULTS

43 vs. 62 patients were confirmed as IDH-wildtype or IDH-mutant, respectively. Demographic and clinical characteristics showed no significant difference between the training set and validation set. The IDH-wildtype cohort showed significant higher age and higher WHO grade compared with IDH mutant group. Thus, age and WHO grade were added to SVM classifier. An accuracy of 95.2% in the test set was achieved to predict IDH genotype. The 10 features (age, grade, APTw_mean, APTw_10th percentile, APTw_25th percentile, MT_75th percentile, etc.) that contributed most to the model are presented (B).

CONCLUSION

Our SVM model presented here achieved an accuracy of 95.2% in the test set. The findings support the use of textures extracted from APTw and MT MRI to aid the accurate diagnostic classification of IDH genotype.

CLINICAL RELEVANCE/APPLICATION

The textures extracted from APTw and MT MRI could be used in the accurate diagnostic classification of IDH genotype in patients with WHO grade-II and -III gliomas.

SSG15-02 Identifying Recurrent Tumor in Post-treatment Glioblastomas with Volumetric Amide Proton Transfer-Weighted (APTw) Image Metrics as Biomarkers

Tuesday, Nov. 27 10:40AM - 10:50AM Room: S403B

Participants
Shanshan Jiang, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Hye-Young Heo, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Yi Zhang, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Jinyuan Zhou, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Post-treatment glioblastomas are biologically complex and often demonstrate highly variable imaging characteristics. Currently

Post-treatment glioblastomas are biologically complex and often demonstrate highly variable imaging characteristics. Currently, patients with suspected recurrent tumor are often referred for repeat surgery to obtain pathologic confirmation due to the lack of reliable imaging modalities. APTw-MRI is a novel molecular imaging technique that generates contrast primarily based on endogenous cellular proteins. Here, we assessed whether volumetric APTw-MRI metrics could identify recurrent tumor in a heterogeneous background in patients with suspected recurrent glioblastoma.

METHOD AND MATERIALS

31 patients with suspected recurrent glioblastoma were enrolled. MRI sequences included T1w, T2w, FLAIR, Gd-T1w, and volumetric APTw sequences. Diagnosis was made by the RANO criteria and pathological results. Volumes of interest (VOIs) were drawn by a neuroradiologist and a research scientist separately. Three ratios of the volumes of Gd-enhancement, abnormal FLAIR intensity, and APTw hyperintensity were recorded: VGd/VFLAIR, VAPT/VFLAIR, and VAPT/VGd. APTw histogram parameters, including mean, mode, and percentiles, calculated from both VOIs on Gd-T1w and FLAIR images (Fig. 1A, B).

CONCLUSION

Volumetric APTw image metrics are valuable predictors of tumor recurrence in patients with suspected recurrent glioblastoma treated with standard chemoradiation.

CLINICAL RELEVANCE/APPLICATION

APTw-MRI is totally noninvasive and now commercially available, and the results can be readily translated into improved diagnostics for patients with suspected recurrent brain tumors.

SSG15-03 Evaluation of Early Acute Radiation-Induced Brain Injury: Hybrid Multifunctional MR Imaging Based Study

Tuesday, Nov. 27 10:50AM - 11:00AM Room: S403B

Participants
Jun Yang, MD, Kunming, China (*Presenter*) Nothing to Disclose
Qinqing Li, Kunming, China (*Abstract Co-Author*) Nothing to Disclose
Chengde Liao, MD, Kunming, China (*Abstract Co-Author*) Nothing to Disclose
Dan Han, MD, Kunming, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

imdyang@163.com

PURPOSE

Accidental or deliberate radiation injury is a serious threat to humans that requires prompt accurate diagnosis and assessment. At present, there is no effective imaging method to evaluate the extent of acute radiation brain injury at early stage. We use DCE, IVIM-MRI and 1H-MRS to noninvasively evaluate acute radiation-induced brain injury.

METHOD AND MATERIALS

SD rats were divided into five groups and four groups received a single radiation treatment to the whole brain. The different extent of brain injury was created by exposure different radiation dose, 10, 20, 30, 40Gy respectively. DCE, IVIM-MRI and MRS was performed on day 5 post radiation injury.The correlation between parameters and radiation dose grade was analyzed using Spearman's rank correlation coefficients. ROC analysis of each MRI parameter was carried to differentiate the extent of radiation exposure. Immunohistochemistry, western blot and transmission electron microscopy were used to determine radiation-induced histopathological changes of neurons and glial cells.

RESULTS

For DCE, Ktrans, Ve, Vp and AUC increased significantly with the radiation dose increase. For IVIM, S0, f and D* also increased significantly with the radiation dose increase. For Ktrans, Ve and AUC in DCE and S0, f and D* in IVIM, the value in 30Gy group was significantly higher than other groups ($P<0.05$). The ratio of NAA/Cr in the 30Gy group was significantly lower than other groups and the ratio of NAA/Cho was increase from 10Gy to 20Gy group, but decreased significantly in the 30Gy group ($P<0.05$). VEGF and caspase-3 expression in the cortex was increased with the irradiation dose increasing from10 Gy to 30 Gy ($P<0.05$). Astrocyte population elevated with radiation dose increase ($P<0.05$).MBP staining did not show differences among the sham-radiation and every radiation groups ($P>0.05$). ROC analysis demonstrated that DCE and IVIM parameters are more effective for diagnosing the 30Gy group, but lower for the 10Gy and 20Gy groups.

CONCLUSION

Hybrid multifunctional MRI parameters can non-invasively evaluate acute radiation-induced brain injury at early stage, especially high dose radiation exposure.

CLINICAL RELEVANCE/APPLICATION

In the event of acute radiation exposure accidents, radiation damage can be detected non-invasively by MR imaging markers and used to determine the extent of brain injury without the need for invasive histopathological analysis.

SSG15-04 Glioma Survival Prediction with the Combined Analysis of Multi-Modal MRI, Histopathology, and Patient Characteristics by Supervised Machine Learning

Tuesday, Nov. 27 11:00AM - 11:10AM Room: S403B

Participants
Lin-Feng Yan, Xi'an, China (*Presenter*) Nothing to Disclose
Yu-Chuan Hu, Xi'an, China (*Abstract Co-Author*) Nothing to Disclose
Ying-Zhi Sun, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Yu Han, Xi'an, China (*Abstract Co-Author*) Nothing to Disclose
Qiang Tian, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Xin Zhang, Xian, China (*Abstract Co-Author*) Nothing to Disclose

Yang Yang, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Jin Zhang, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Ying Yu, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Qian Sun, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Bo Hu, MD, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Zhongqiang Shi, Xi an, China (*Abstract Co-Author*) Nothing to Disclose
Xiao-Cheng Wei, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Guang-Bin Cui, MD, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Wen Wang, Xi'an, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

ylf8342@163.com

PURPOSE

To establish a survival prediction model for gliomas based on multi-modal MRI, ex vivo histopathology and patient characteristics.

METHOD AND MATERIALS

102 patients with pathologically confirmed WHO I-IV gliomas and complete survival information were retrospectively included. All patients received fluid attenuated inversion recovery, contrast enhanced T1-weighted image, three dimensional pseudo-continuous arterial spin labeling, intravoxel incoherent motion diffusion-weighted images (IVIM-DWI) and dynamic contrast enhanced MRI (DCE-MRI) before surgery. After surgery, histopathology-derived ex vivo features according to WHO 2016, such as tumor grade, histology, isocitrate dehydrogenase mutation status and the methylation of oxygen 6-methylguanine-DNA methyltransferase promoter have been acquired. The histogram and textural features were extracted from tumor volume of interests in each parametric map derived from multi-modal MRI. As for feature selection, pearson correlation and single factor cox regression were utilized to identify relevant features for predicting 2-year overall survival. The multi-factor cox model based on the histopathology and patient characteristics (partial-feature) or their combinations with multi-modal MRI features (full-feature) were established, respectively. Three approaches such as likelihood ratio, Wald and Score (log-rank) test were used to verify the two predictive models.

RESULTS

The predictive model based on the full-feature performed better than that based on partial-feature. The most contributing features to predict overall survival were tumor location, patient age, textural features from DCE-MRI and IVIM-DWI. The likelihood ratio of the full-feature model was 98.23 ($p<0.0001$),while that of the partial-feature one was 62.48 ($p<0.0001$). The hazard ratio of selected image features derived from DCE-MRI and IVIM-DWI were 0.51 ($p = 0.0003$) and -2.37 ($p = 0.0002$) respectively.

CONCLUSION

Survival prediction of glioma patients based on full features containing multi-modal MRI, histopathology and patient characteristics is more accurate than that without multi-modal MRI.

CLINICAL RELEVANCE/APPLICATION

While survival is associated with molecular biomarkers, diagnostic work-up of patients with suspected glioma mainly done by using multi-modal MRI holds great potentials in glioma characterization.

SSG15-05 Clinical Impact of Time Interval Between Gross Total and Subtotal Resection of Glioblastoma and Radiotherapy Using a Large National Database

Tuesday, Nov. 27 11:10AM - 11:20AM Room: S403B

Awards
Student Travel Stipend Award

Participants
Samantha M. Buszek, MD, Houston, TX (*Presenter*) Nothing to Disclose
Karine Al Feghali, MD, Beirut, Lebanon (*Abstract Co-Author*) Nothing to Disclose
Hesham Elhalawani, MD, MSc, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Neil Chevli, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Pamela Allen, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Caroline Chung, MD, FRCPC, Houston, TX (*Abstract Co-Author*) Research Grant, Elekta AB; Research Grant, RaySearch Laboratories AB; Advisory Board, RaySearch Laboratories AB; Advisory Board, Novocure Ltd

For information about this presentation, contact:

smbuszek@mdanderson.org

PURPOSE

Glioblastoma (GBM) is the most common primary malignant brain tumor in adults and standard of care treatment includes maximal safe surgical resection followed by adjuvant radiotherapy (RT) and chemotherapy. The optimal time interval between surgery and the initiation of adjuvant therapy remains unclear.

METHOD AND MATERIALS

The NCDB was queried for adult patients with diagnostic codes for GBM diagnosed from 2004 to 2015 who were treated with RT following surgical resection. Time interval between surgery and the start of RT were grouped into a. <= 4 weeks, b. 4.1-6 weeks, c. 6.1-8 weeks, and d. >8 weeks. Overall survival (OS) was estimated using Kaplan-Meier and log-rank test methods. Univariate (UVA) and multivariable (MVA) modeling with Cox regression analysis was used to determine predictors of OS.

RESULTS

A total of 46,012 patients, with a median age of 61 years (range 18-90 years) met inclusion criteria. Median time interval from resection to RT was 29 days (range 1-620 days). A total of 11,480 patients underwent a gross total resection (GTR) and 13,608

underwent a subtotal resection or biopsy (STR). Median survival was significantly different between time interval groups: 13.9, 15.2, 14.4, and 14.7 months, groups a-d respectively (p<0.0001). Using all variables significant on UVA, the following variables were associated with better OS on MVA: higher KPS, lower age, female gender, black ethnicity, methylated status, unifocal disease, and treatment initiation of RT >4 weeks. When separated by resection status, these variables remained significant; however patients with GTR initiated on RT >8 weeks had worse survival (HR 1.23, p=0.007) whereas patient's with STR did not.

CONCLUSION

Consistent with prior smaller series, this large retrospective analysis of the NCDB suggests that patients with newly diagnosed GBM who start RT within four weeks of surgical resection have worse outcomes. In terms of prolonged delay from surgery to RT, patients with GTR had worse OS if they initiated RT after 8 weeks whereas patients with STR did not. This finding should be considered in the future designs of clinical trials.

CLINICAL RELEVANCE/APPLICATION

This study aims to use the National Cancer Database (NCDB) to identify predictors for and clinical impact of time from surgical resection to initiation of RT in patients with newly diagnosed GBM.

SSG15-06 Assessment of the Alpha/Beta Ratio of the Optic Pathway

Tuesday, Nov. 27 11:20AM - 11:30AM Room: S403B

Participants
Herwin Speckter, Santo Domingo, Dominican Republic (*Presenter*) Nothing to Disclose
Jose Bido, Santo Domingo, Dominican Republic (*Abstract Co-Author*) Nothing to Disclose
Giancarlo Hernandez, Santo Domingo, Dominican Republic (*Abstract Co-Author*) Nothing to Disclose
Diones Rivera, Santo Domingo, Dominican Republic (*Abstract Co-Author*) Nothing to Disclose
Luis Suazo, Santo Domingo, Dominican Republic (*Abstract Co-Author*) Nothing to Disclose
Santiago Valenzuela, Santo Domingo, Dominican Republic (*Abstract Co-Author*) Nothing to Disclose
Cesar F. Gonzalez Saladin, MD, Santo Domingo, Dominican Republic (*Abstract Co-Author*) Nothing to Disclose
Peter Stoeter, Los Cacicazgos, Dominican Republic (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

hspeckter@cedimat.net

PURPOSE

Hypofractionation has been recently considered an alternative to improve stereotactic radiosurgery of lesions in close proximity of the optic pathways. To estimate the intrinsic benefit from fractionation versus single dose radiosurgery for peri-optic lesions, the value of the alpha/beta ratio of the optic pathways has to be taken into account. Most studies expect and use an alpha/beta ratio of 2 Gy, or even 3 Gy, for the visual system. So far, to our knowledge, only 3 alpha/beta ratios have been published: In 1992 Goldsmith and Larson published an alpha/beta ratio of 3.06 Gy, which means that there would be no benefit of hypofractionation for most benign lesions. In 1994 Jiang estimated a ratio of 1.6 Gy based on relatively few data from a single center study. In 2010 Vernimmen derived a negative value of -0.6 Gy, and remarked that a negative value is not permitted by the LQ model.

METHOD AND MATERIALS

The alpha/beta ratio of the optic pathways was estimated from a meta analysis of 388 studies published since 2000. We included 27 studies with fraction numbers between 1 and 31, considering the following inclusion criteria: frequency of radiation induced optical neuropathy RION between > 0 %, and < 10 %, follow up of at least 12 months, no tumor progression, no prior radiation, detailed dosimetric analysis for the visual system. Clinical data provided from our center were added, including 54 hypofractionated Gamma Knife Radiosurgery regimens (4 treatments with 5 sessions, 45 treatments with 4 sessions, and 5 treatments with 3 sessions) and 106 single session treatments of different lesions close to the optic pathways.

RESULTS

The FE plot method revealed an alpha/beta ratio of the optic system of 1.11 Gy, confidence interval [0.39 - 3.59]. There is still not enough data in order to distinguish between alpha/beta ratios of the optic chiasm, the nerves and the tracts.

CONCLUSION

A significant intrinsic benefit from hypofractionation can be expected not only for malignant tumors located in the sellar region but for benign lesions as well, because of the very low alpha/beta ratio of the optic system of 1.11 Gy.

CLINICAL RELEVANCE/APPLICATION

The knowledge of the alpha/beta ratio of the optic system helps to optimize fractionation regimens for peri-optical tumors, facilitating dose restraints, BED and single fraction equivalent doses.

SSG15-07 Repeat Whole Brain Radiation Therapy Using a Pulsed Reduced Dose Rate Technique

Tuesday, Nov. 27 11:30AM - 11:40AM Room: S403B

Participants
Sara Kelm, Wauwatosa, WI (*Presenter*) Nothing to Disclose
Vanica Guignard, Wauwatosa, WI (*Abstract Co-Author*) Nothing to Disclose
Maikel Botros, MD, Wauwatosa, WI (*Abstract Co-Author*) Nothing to Disclose
Benjamin Gillingham, Wauwatosa, WI (*Abstract Co-Author*) Nothing to Disclose
Joseph A. Bovi, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Christopher J. Schultz, MD, Milwaukee, WI (*Abstract Co-Author*) Medical Advisory Board, Prism Clinical Imaging, Inc
Jennifer Connelly, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Malika L. Siker, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

skelm@mcw.edu

PURPOSE

Limited salvage options exist for patients with multiple recurrent brain metastases previously treated with whole brain radiation therapy (WBRT). Pulsed reduced dose rate radiation therapy (PRDR) is a unique irradiation strategy that lowers the effective dose rate, potentially decreasing toxicity to normal tissue by allowing for sublethal damage repair. PRDR is safe and effective in patients with gliomas receiving partial brain re-irradiation. To our knowledge, this technique has not been reported before in patients with brain metastases who have received repeat WBRT with PRDR. We report our early outcomes.

METHOD AND MATERIALS

We conducted a retrospective review of patients with brain metastases who received repeat WBRT with PRDR at the time of clinical and/or radiographic progression. PRDR treatments were delivered with a series of 0.20 Gy pulses given over a 3-minute period. Patients were treated with parallel-opposed whole brain lateral fields with dose prescribed to isocenter.

RESULTS

We identified 26 patients who received WBRT with PRDR since 2012. We excluded 4 patients as 2 patients had no prior WBRT and 2 expired during treatment due to extracranial disease. Primary histology included breast cancer, melanoma, NSCLC, non-seminomatous testicular cancer, SCLC and sarcoma. Initial WBRT dose regimens included 30 Gy in 10 fractions, 37.5 Gy in 15 fractions, and 39.6 Gy in 18 fractions. KPS was 70-100 for all patients at time of first WBRT. Median time to progression after first WBRT was 7.7 months at which time patients underwent repeat WBRT with PRDR. Patients received daily fractions of 2 - 3 Gy to a total dose of 20 Gy - 30 Gy. KPS at repeat irradiation was 70-100. With a mean follow-up of 7.1 months, mean time to intracranial progression after repeat WBRT with PRDR was 4.7 months. Four patients had intracranial disease control after repeat WBRT with PRDR for > 6 months and 1 patient is still alive at the time of this review. No acute grade 3 toxicities were seen as a result of reirradiation based on CTCAE v4.03. Grade 1/2 toxicities included fatigue, anorexia, and alopecia.

CONCLUSION

To our knowledge, this is the first report of repeat WBRT with PRDR. This technique appears to be a safe and feasible option for patients with multiple brain metastases who previously received WBRT.

CLINICAL RELEVANCE/APPLICATION

Future prospective studies using this technique are being considered to determine use as salvage therapy.

SSG15-08 Whole Ventricular Irradiation and Neoadjuvant Chemotherapy for Pure Intracranial Germinoma: A Comparison of Three Dose-Sparing Techniques

Tuesday, Nov. 27 11:40AM - 11:50AM Room: S403B

Awards
Trainee Research Prize - Medical Student

Participants
Jason D. Nosrati, BA, Grand Rapids, MI (*Presenter*) Nothing to Disclose
Kenneth Wong, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Arthur Olch, PHD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

Jnosrati@live.com

PURPOSE

Radiation therapy (RT) plays a major role in the management of pure CNS germinoma, a disease most commonly seen in children 10-19 years of age. Awareness of late effects of RT has led to a shift in the focus of research to maintaining high cure rates with treatments such as chemotherapy with whole ventricular irradiation (WVI). In the present study, we evaluate three brain-sparing treatment techniques for pure intracranial germinomas with dose-volume analysis of normal brain structures.

METHOD AND MATERIALS

Four patients with intracranial germinomas were treated with chemotherapy followed by 22.5 Gy WVI with simultaneous integrated boost (SIB) to the primary site to 30 Gy. Tumor locations include suprasellar, pineal, or both locations. The SIB plans were replanned with the Japanese (24 Gy WVI only) and current Children's Oncology Group (COG) treatment paradigms (18 Gy WVI with primary site boost to 30 Gy). Target volumes were contoured from registered diagnostic MRIs and included the whole ventricular volume (WVV) and boost volume. Organs at risk (OAR) included hippocampi, temporal lobes, whole brain, and brain-WVPTV. V12, V18, and V20 were recorded for each of these structures, and dose-volume metrics were recorded for all 12 plans. PTV dose-volume coverage and OAR sparing were compared.

RESULTS

For the SIB protocol, the mean total brain V12, V18, and V20 were 59%, 34%, and 28%, respectively; the COG protocol values were 48%, 27%, and 20%; and the WVI values were 57%, 33%, and 28%. Analyzed across 4 patients with varying WVV and boost volumes, the WVI plan giving 24 Gy to the WVV without boost did not result in lower OAR dose-volume metrics yet underdosed the primary by 6 Gy compared to the other two treatment methods. The COG paradigm further reduced the dose to normal brain by reducing the WVPTV dose to 18 Gy while maintaining the 30 Gy boost PTV dose.

CONCLUSION

The WVI treatment plan may not reduce neurocognitive deficits yet potentially risks failure to control the primary site. The COG plan may result in even better neurocognitive outcomes than the SIB treatment, but whether there is an increase in ventricular failures remains to be seen.

CLINICAL RELEVANCE/APPLICATION

Minimization of cognitive late effects during treatment planning for CNS Germinoma is not enhanced by omission of a boost dose to

30 Gy to the primary tumor.

SSG15-09 Biomechanical Model-Based Deformable Image Registration for Glioma Patients

Tuesday, Nov. 27 11:50AM - 12:00PM Room: S403B

Participants
Molly McCulloch, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Brian Anderson, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Samantha M. Buszek, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Karine Al Feghali, MD, Beirut, Lebanon (*Abstract Co-Author*) Nothing to Disclose
Hesham Elhalawani, MD, MSc, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Guillaume Cazoulat, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Caroline Chung, MD, FRCPC, Houston, TX (*Abstract Co-Author*) Research Grant, Elekta AB; Research Grant, RaySearch Laboratories AB; Advisory Board, RaySearch Laboratories AB; Advisory Board, Novocure Ltd
Kristy K. Brock, PhD, Houston, TX (*Presenter*) License agreement, RaySearch Laboratories AB

For information about this presentation, contact:

mmmcculloch@mdanderson.org

PURPOSE

Assessment of treatment response for gliomas requires alignment of pre- and post-radiotherapy (RT) images. Large deformations in gross tumor volume (GTV) and surrounding brain can occur due to edema and tumor or surgical cavity growth or shrinkage. These large shifts can propose challenges in aligning serial images. The purpose of this study is to evaluate the accuracy of biomechanical model-based deformable image registration (DIR) driven by modeling the GTV volumetric response.

METHOD AND MATERIALS

Serial MR images of 10 glioma patients from post-surgery/pre-RT and post-RT were imported into an RT treatment planning system for analysis. GTV, ventricles, right and left hippocampi, brainstem and optic chiasm were delineated on each image. Automated rigid registration (RR) was performed between the pre- and post-RT MR images, followed by a biomechanical model-based DIR with boundary conditions on the GTV. Normal tissue contours were propagated from the pre-RT MR to the post-RT MR. The accuracy of the DIR method was evaluated using dice similarity coefficient (DSC) for each propagated contour.

RESULTS

The DSC was calculated between each propagated and original contour on the post-RT MR for both RR and DIR. Rigid registration was sufficient for 9 out of 10 patients in this limited cohort, as they did not have significant GTV or brain changes. In one patient with a large tumor (55 cm3), we qualitatively noted normal tissue shifts and tumor response due to treatment. In this patient, the use of DIR improved DSC for the ventricles from 0.56 to 0.74, left hippocampus from 0.36 to 0.48, and right hippocampus from 0.68 to 0.71.

CONCLUSION

In cases demonstrating therapeutic response of the tumor, biomechanical model-based DIR improves alignment compared to RR alone. This method was particularly beneficial for one patient in this limited cohort. Additional patients are needed to further evaluate impact and accuracy. These models will also aid in tracking the delivered dose and incorporating delivered dose into an adaptive protocol for glioma patients.

CLINICAL RELEVANCE/APPLICATION

For patients with therapeutic response to glioma, biomechanical model-based DIR is beneficial in alignment of normal tissues during RT, potentially aiding in tracking delivered dose.

ROS-TUA

Radiation Oncology Tuesday Poster Discussions

Tuesday, Nov. 27 12:15PM - 12:45PM Room: RO Community, Learning Center

RO

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Tarita O. Thomas, MD, PhD, Chicago, IL (*Moderator*) Nothing to Disclose

Sub-Events

RO211-SD-TUA1 Institutional Experience Treating Locally Advanced Non-Melanomatous Cutaneous Malignancies of the Head and Neck with Intensity Modulated Radiation Therapy (IMRT)

Station #1

Participants
Lucas Gilbride, MD, Milwaukee, WI (*Presenter*) Nothing to Disclose
Mohamed Abdelhakiem, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Adam D. Currey, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Jared R. Robbins, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Advanced non-melanomatous skin cancers of the head and neck pose a challenge to treating physicians due to complicated and often morbid surgical procedures. Superficial radiation therapies can be difficult to deliver due to irregular body/tumor contours and nearby critical structures. Therefore different forms of intensity modulated radiation therapy (IMRT) may provide an effective and safe treatment modality for these patients.

METHOD AND MATERIALS

Sixty-seven patients with basal cell carcinoma (n=19) or cutaneous squamous cell carcinoma (n=48) of the head and neck treated between 2004 and 2018 with IMRT at a single institution were retrospectively reviewed. Baseline characteristics of the patients included: age (mean 73.3 yrs), innumocompromised (n=14), recurrent disease (n=31), Stage III/IV (n=44), tumor size (mean 3.9 cm), satellitosis (n=20), poorly differentiated histology (n=24), and PNI (n=20). Surgery was performed prior to IMRT in 25 patients with 12 having positive margins. Chemotherapy was used in 11 patients. Radiation therapy doses ranged from 37.5-70 Gy (mean 57.1 Gy) at 1.8-3.0 Gy/fraction.

RESULTS

After a median follow up of 32 months there were 20 local failures, 6 regional failures, and 3 distant failures leading to an estimated median recurrence free survival of 50.2 months. The estimated median overall survival was 72.2 months. Almost all patients experienced acute skin toxicity during the course of their treatment but only 5 patients experienced Grade 3 skin toxicity. The most common late toxicities were alopecia (n=38), telangiectasia (n=28), hypopigmentation (n=17), hyperpigmentation (n=5), skin atrophy (n=7), fibrosis (n=4), and skin ulceration (n=5). One patient developed osteoradionecrosis but the tumor had extensive involvement of the external auditory canal. However, no patients demonstrated evidence of brain radionecrosis.

CONCLUSION

Locally advanced non-melanomatous cutaneous malignancies of the head and neck pose a unique challenge to treating physicians. IMRT providess a treatment option that affords patients a durable recurrence free survival with acceptable toxicity and reasonable cosmetic outcomes.

CLINICAL RELEVANCE/APPLICATION

This single institution experience demonstrates the effectiveness and safety of treating advanced non-melanomatous malignancies of the head and neck with IMRT.

RO212-SD-TUA2 A Correlation Study of Epidermal Growth Factor Receptor Gene Mutations, Computed Tomography Image Findings, and Clinical Features Among Patients with Pulmonary Adenocarcinoma

Station #2

Participants
Tongxin Xu, Shijiazhuang, China (*Presenter*) Nothing to Disclose
Gaofeng Shi, MD, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To explore the correlation between computed tomography (CT) findings and epidermal growth factor receptor (EGFR) status, and the correlation between clinical features and EGFR mutations.

METHOD AND MATERIALS

The study cohort included 192 pulmonary adenocarcinoma patients (82 men and 110 women; age range,32-83 years)who

underwent tumor resection at No.4 Hospital of Hebei Medical University between January 2015 and October 2015. Of these patients, 108 had symptoms of cough, expectoration, and/orhemoptysis. There were 56 smokers and 136 non-smokers, 46 drinkers and 146 nondrinkers. CT scans were conducted on a dual-source CT (SOMATOM Definition Flash, Siemens Healthcare, Erlangen, Germany) at 120 kV, 110mAs, 0.2-s rotation, 0.6 pitch, and 128×0.6 collimation. CT images were evaluated for the presence of ground glass opacity (GGO), cavitation, marginal spiculation, marginal lobulation, and pleural indentation. GGO proportions and maximum diameters of tumors were measured.

RESULTS

EGFR mutationswerefound in 115 patients (59.8%) with a significantly greater mutation rate in females (73.6%; p<0.001). Wild-type EGFR was more commonin smokers(p<0.001).The mutation was more commonin patients without symptoms (p=0.022).The mutation rate in nondrinkers and drinkers was 65.1% and 43.4%, respectively (p=0.009). EGFR mutation occurred more often in patients with atumor diameter of <=30 mm (p=0.003).Mutation was more commonin tumors with pleural indentation (p=0.002). The EGFR mutation rate wasnot correlated with GGO, speculation, lobulation, or cavitation. The mutation of exon19 was more commonin tumors with GGO (p=0.013).

CONCLUSION

EGFR mutation wasmore prevalent in females without symptoms, who neithersmoked nor drank alcohol. The mutation occurred more frequently in tumors with pleural indentation and a diameter <=30 mm. The mutation rate of exon19 was higher in tumors with GGO.

CLINICAL RELEVANCE/APPLICATION

(dealing with EGFR mutation) "EGFR mutation was more prevalent in females without symptoms, who neither smoked nor drank alcohol. The mutation occurred more frequently in tumors with pleural indentation and a diameter <=30 mm. The mutation rate of exon19 was higher in tumors with GGO. EGFR mutation is recommended in helping to improve patient management in their treatment plan."

RO213-SD-TUA3 Evaluation of Focal Liver Reaction after Proton Beam Therapy for Liver Metastasis Examined Using Gd-EOB-DTPA Enhanced Hepatic Magnetic Resonance Imaging

Station #3

Participants
Shigeyuki Takamatsu, MD, PhD, Kanazawa, Japan (*Presenter*) Nothing to Disclose
Miu Mizuhata, MD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Satoshi Shibata, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshitaka Sato, Fukui, Japan (*Abstract Co-Author*) Nothing to Disclose
Sayuri Bou, Fukui, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroyasu Tamamura, Fukui, Japan (*Abstract Co-Author*) Nothing to Disclose
Satoshi Kobayashi, MD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomoyasu Kumano, Ishikawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Gabata Toshifumi, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

shigerad@staff.kanazawa-u.ac.jp

PURPOSE

Focal liver parenchymal damage in radiotherapy is described as the focal liver reaction (FLR); the threshold doses (TDs) for FLR in the background liver have been analyzed in proton beam therapy (PBT). To develop a safer approach for PBT, both TD and liver volume changes are considered clinically important in predicting the extent of damage before treatment, and subsequently in reducing background liver damage. We investigated appearance time, TDs and volume changes regarding FLR after PBT for normal liver with hepatic metastasis.

METHOD AND MATERIALS

This retrospective analysis of the data was approved by the institutional review board of our institution. Patients who were treated using PBT and were followed up using gadolinium ethoxybenzyl diethylenetriamine pentaacetic acid-enhanced magnetic resonance imaging (Gd-EOB-DTPA MRI) after PBT were enrolled. Eight patients were eligible for analysis (median age, 74 years). The primary lesions were colon cancer (6 cases), cholangiocellular carcinoma (1 case) and pancreas cancer (1 case), total doses of 71.2 (60-83.6) cobalt Gy equivalent (CGE), 17 (8-34) fractions (Fr), and BED10: 109CGE (72-115). MRI was acquired at the end of treatment, and at 1, 2, 3 and 6 months after PBT. We defined the FLR as a clearly depicted hypointense area on the hepatobiliary phase of Gd- EOB-DTPA MRI, and we visually monitored TDs. Based on the TD defined by MRI at 3 months after PBT, we hypothesized the irradiated liver area receiving a dose greater than the TD isodose lines at planning MRI as the destined FLR area (dFLR). The volume of the dFLR was calculated and compared with the FLR volume on follow-up MRI.

RESULTS

FLR was depicted in all lesions at 3 months after PBT. TDs were expressed as the 2-Gy equivalent dose, 24.4Gy (a/ß = 2 Gy), 25.3Gy (a/ß = 3 Gy) and 24.2Gy (a/ß = 8 Gy). The volume of the dFLR area decreased and the residual liver volume increased, particularly during the initial 3 months.

CONCLUSION

This study established the FLR dose and volume change for normal liver, which might be useful in the prediction of remnant liver volume for normal liver.

CLINICAL RELEVANCE/APPLICATION

We could investigate the FLR dose and volume change for normal liver, which might be useful in the prediction of remnant liver volume after PBT for normal liver.

RO214-SD-TUA4 Pulmonary Metastases from Pancreatic Cancer: Frequency of Atypical Radiological Features and Comparison with Pulmonary Metastases from Colorectal Cancer

Station #4

Participants
Ilaria Vicentin, MD, Vicenza, Italy (*Presenter*) Nothing to Disclose
Mattia Pecorilla, MD, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Roberto Ronza, Caserta, Italy (*Abstract Co-Author*) Nothing to Disclose
Cristiano Sgrazzutti, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Claudia Khouri Chalouhi, MD, Settala, Italy (*Abstract Co-Author*) Nothing to Disclose
Angelo Vanzulli, MD, Segrate, Italy (*Abstract Co-Author*) Travel support, Bracco Group

For information about this presentation, contact:

ilaria.vicentin@libero.it

PURPOSE

To compare the frequency of radiological CT features of lung metastases from pancreatic adenocarcinoma (PC) versus those from colorectal cancer (CRC).

METHOD AND MATERIALS

In this retrospective observational study 2 radiologists independently reviewed CT images of 182 patients with newly detected pulmonary metastases (86 with PC, 96 with CRC) diagnosed between October 2005 and December 2017. Lung lesions were classified into 5 categories on the basis of the radiological aspect: solid nodule with smooth margins, solid nodule with spiculated margins, cavitated nodule, solid nodule with halo sign, ground glass nodule. In case of multiple metastases, the two largest lesions or those with different features were considered. For examinations with disagreement between the 2 radiologists, a consensus review was obtained.

RESULTS

We evaluated 165 pulmonary metastases from PC and 172 pulmonary metastases from CRC. Among those from PC, 64(38,8%) were solid with smooth margins, 25(15,2%) were solid with spiculated margins, 32(19,4%) were cavitated, 33(19,9%) were solid with halo sign, 11(6,6%) were ground glass. Among those from CRC, 108(62,8%) were solid with smooth margins, 38(22,1%) were solid with spiculated margins, 20(11,6%) were cavitated, 4(2,3%) were solid with halo sign, 2(1,2%) were ground glass.

CONCLUSION

CT features of pulmonary metastases from PC are very different from those of colorectal origin. In particular, an increased frequency of ground glass components (ground glass nodules and solid nodules with halo sign) emerged in pulmonary metastases from PC compared to those from CRC (26.5% vs 3.5%); in pulmonary metastases from CRC solid nodules with smooth margins were prevalent (62.8% vs 38.8% of pancreatic metastases).

CLINICAL RELEVANCE/APPLICATION

Pulmonary metastases from Pancreatic Cancer show peculiar radiological features, in particular when considering the ground glass components which are significantly more frequent than in Colorectal metastases.

ROS-TUB

Radiation Oncology Tuesday Poster Discussions

Tuesday, Nov. 27 12:45PM - 1:15PM Room: RO Community, Learning Center

RO

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Tarita O. Thomas, MD, PhD, Chicago, IL (*Moderator*) Nothing to Disclose

Sub-Events

RO216-SD-TUB1 Long-Term Outcome of Low-Dose Rate Brachytherapy with I-125 Seeds as a Monotherapy for High-Risk Prostate Cancer Patients: A Propensity Score-Matched Analysis

Station #1

Participants
Takashi Kawanaka, MD, PhD, Tokushima, Japan (*Presenter*) Nothing to Disclose
Akiko Kubo, MD, Tokushima, Japan (*Abstract Co-Author*) Nothing to Disclose
Shunsuke Furutani, Tokushima, Japan (*Abstract Co-Author*) Nothing to Disclose
Chisato Tonoiso, MD, Tokushima, Japan (*Abstract Co-Author*) Nothing to Disclose
Hitoshi Ikushima, MD, Tokushima, Japan (*Abstract Co-Author*) Nothing to Disclose
Masafumi Harada, MD, PhD, Tokushima, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aims of this study is to report long-term outcome of patients treated with I125 low-dose-rate brachytherapy (LDR-BT) as a monotherapy for high-risk prostate cancer with a minimum five years follow-up after the LDR-BT using a propensity score-matched analysis

METHOD AND MATERIALS

A group of 498 patients with clinically localized prostate cancer treated with I125 LDR-BT between July 2004 and October 2012 at our University Hospital were identified. Of the 498 patients, 223 (44.8%) had low-risk disease, 205(41.2%) had intermediate-risk disease, 70 (14.1%) patients had high-risk disease. Cohorts were categorized according to D'Amico's risk classification, and biochemical outcomes plus overall survival were examined. Biochemical failure was defined as nadir prostate-specific antigen (PSA) level + 2 ng/mL. A propensity score matching analysis (PSM) was performed using a logistic regression for high-risk patients.

RESULTS

A total of 498 patients met the criteria with a median follow-up of 107 months (range 18-158 months). The median age was 67.5 years (range 49-82) at the time of treatment. The 5- and 10-year biochemical failure-free survival rates were 100 and 98.7% for low-risk group, 95.2 and 93.0% for the intermediate-risk group 84.3 and 81.8% for the high-risk group, respectively. Under the PSM of the 70 high-risk patients, age during 65 to 75 years group has significant superior biochemical failure-free survival rates compare to another age group (93.3 vs. 75.0% at five years, p=0.04). Treatment age, D90, V100, hormonal therapy and count of a high-risk factor were associated with biochemical failure-free survival on univariate analysis in a high-risk group. Additionally treatment age, hormonal therapy and D90 were associated with biochemical failure-free survival in multivariate models.

CONCLUSION

This study shows that LDR-BT monotherapy has acceptable cancer control even in high-risk prostate cancer patients with proper treatment technic and patient selection under PSM.

CLINICAL RELEVANCE/APPLICATION

LDR-BT monotherapy has acceptable cancer control even in high-risk prostate cancer patients with proper treatment technic and patient selectio.

RO217-SD-TUB2 The Diagnostic Value of Intravoxel Incoherent Motion Diffusion Weighted Imaging in Different Pathological Types of Cervical Carcinoma in 3.0T MRI

Station #2

Participants
Dong Jiangning, Hefei, China (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

dongjn@163.com

PURPOSE

To explore the diagnostic value of the parameters of the intaravoxel incoherent motion diffusion-weighted imaging in 3.0T magnetic resonance imaging for different pathological histological types of cervical carcinoma.

METHOD AND MATERIALS

A retrospective analysis of 101 cases of cervical carcinoma confirmed by surgery and pathology in our hospital, including11 cases of cervical adenocarcinoma(Fig A1-A7), 87 cases of cervical squamous cell carcinoma(Fig B1-B7)and 3 cases of cervical small cell carcinoma(Fig C1-C7). Intravoxel incoherent motion diffusion-weighted imaging was performed by using 10b values (b=0,10,20,50,100,200,400,800,1200,2000s/mm2).The Statistical analysis software SPSS 22.0 was used to statistically analyze the differences between different types of cervical cancer. The receiver operating characteristic (ROC) curve was used to evaluate IVIM-DWI related parameters for diagnostic the efficiency of different types of cervical cancer.

RESULTS

The ADCstand, D, D* and f values of cervical squamous cell carcinoma were respectively 0.73±0.11)×10-3mm2/s,(0.53±0.12)×10-3mm2/s,(10.84,9.60)×10-3mm2/s,(0.31,0.18); The ADCstand, D, D* and f values of cervical adenocarcinoma were respectively (0.92±0.26)×10-3mm2/s,(0.74±0.11)×10-3mm2/s,(8.67,7.64)×10-3mm2/s,(0.35,0.13); The ADCstand, D, D* and f values of cervical small cell carcinoma were respectively(0.52±0.070)×10-3mm2/s,(0.41±0.084)×10-3mm2/s,(16.13,8.87)×10-3mm2/s,(0.28,0.049) , the comparison of the ADCstand and D value was statistically significant ($P < 0.05$), and the comparison between D* and f value was not statistically significant ($P = 0.185$ and 0.209). The cutoff values of ADCstand and D of cervical adenocarcinoma and cervical squamous cell carcinoma was 0.75×10-3mm2/s and 0.66×10-3mm2/s, and the sensitivity, specificity and the area under the curve were 59.8%, 100%, 0.812, 88.5%, 90.9% and 0.929. The cut off values of ADCstand and D for identifying cervical squamous cell carcinoma and cervical small cell carcinoma were respectively 0.61×10-3mm2/s and 0.49×10-3mm2/s ,the sensitivity, specificity and the area under the curve were 90.8%, 100%, 0.962, 65.5%, 100% and 0.807.

CONCLUSION

The ADCstand, D values of IVIM-DWI related parameters have better diagnostic value for different pathological types of cervical cancer.

CLINICAL RELEVANCE/APPLICATION

It can provide non-invasive and quantitative molecular imaging basis for the individual treatment of cervical cancer.

RO218-SD-TUB3 Evaluation in Correlation of Magnetic Resonance Diffusion Kurtosis Imaging and AQP Expression in Esophageal Carcinoma

Station #3

Participants
Yanfei Wang, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Gaofeng Shi, MD, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Andu Zhang, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Ruxun Li, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Li Yang, MD, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Hui Feng, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Xiaohui Qi, MD, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Tongxin Xu, Shijiazhuang, China (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

feinier_1989@sina.com

PURPOSE

To investigate the expression of AQP expression in mice models with esophageal cancer xenografts before and during radiotherapy and to evaluate whether the AQP levels correlate with magnetic resonance diffusion kurtosis imaging (MR-DKI) values.

METHOD AND MATERIALS

There were 84 Eca-109 nude mice models with esophageal cancer xenogrfts before and during radiotherapy (test group=42; control group=42) used in this study. Seven time points for testing AQP expression and evaluating MR-DKI values selected at 1 day before radiotherapy, and at 1st, 3rd, 5th, 7th, 15th, and 29th days during the radiotherapy. Real-time fluorescence quantitative PCR (RT-PCR) and Western blot were tested the expression of AQP3 levels in the transplanted esophageal carcinoma. The correlation of AQP3 expression and MR-DKI values (using ADC, MK, and MD values) was analyzed and compared.

RESULTS

AQP3 protein levels showed that there was no significant difference at the 1st day before radiotherapy (0.30±0.06 and 0.30±0.06), at the 1st day after radiotherapy (0.30±0.10 and 0.34±0.13), and at the 29th day (0.26±0.02 and0.28±0.03) after radiotherapy ($P=0.868$, 0.337, 0.228), between test and control groups. There were statistically significant differences in levels of AQP3 protein at the 3rd (0.28±0.03 and 0.35±0.06), 5th (0.26±0.07 and 0.37±0.08), 7th (0.23±0.08 and 0.36±0.08), and 15th (0.24±0.03 and 0.31±0.03) days after radiotherapy between the two groups ($P<0.05$). AQP3 gene expression levels were negatively correlated with the MR-DKI ADC value and MD value whereas were positively correlated with the MR-DKI MK value (all $P<0.05$).

CONCLUSION

Esophageal cancer in animal models before radiotherapy and during radiotherapy or during non-radiotherapy showed significantly different in expression of AQP3 levels correlated with MR-DKI values. The MR-DKI imaging values may reflect the tumor sensitivity for radiotherapy and may help to manage patient treatment.

CLINICAL RELEVANCE/APPLICATION

(dealing with MR-DKI) 'Esophageal cancer in animal models before radiotherapy and during radiotherapy or during non-radiotherapy showed significantly different in expression of AQP3 levels correlated with MR-DKI values. The MR-DKI imaging values may reflect the tumor sensitivity for radiotherapy and is recommended in helping to manage patient treatment.'

RO219-SD-TUB4 Hybrid Regularization in Sliding Organ Motion Correction for Motion-Compensated (MoCo) Cone-Beam CT (CBCT)

Station #4

Participants
Shaohua Zhi, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Marc Kachelriess, PhD, Heidelberg, Germany (*Presenter*) Nothing to Disclose
Xuanqin Mou, Xian City, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

zhishaohua.1203@stu.xjtu.edu.cn

PURPOSE

To develop an algorithm to suppress the non-physiological motion, due to the discontinuous movements in the proximity of lung borders for motion-compensated (MoCo) cone-beam volumetric images while maintaining features in the static regions.

METHOD AND MATERIALS

Respiratory motion leads to blurred-artifacts in CBCT scans, which as a result, will influence the accuracy of design of treatment planning in radiation therapy. While the artifact model-based cyclic motion compensation (acMoCo) algorithm [Brehm et al., MedPhys 40(10)] estimates motion vector fields (MVFs) between different respiratory phases, there is still room for reducing the estimation errors especially at the boundaries of sliding organs. The proposed method utilizes the acMoCo results as an initialization to extract motion features by robust principal component analysis (RPCA) and then generates a set of phase-resolved images combined with 3D-FDK reconstruction from the entire projection data as a prior, which incorporates knowledge of static features. The intermediate images are then incorporated into the iterative reconstruction framework to minimize the inconsistency of the corresponding rawdata. We tested the performances of the proposed method on patient data of three radiation therapy patients scanned with the CBCT of a Varian True Beam System.

RESULTS

The proposed method proved to be effective to reduce physiologically incorrect motion in the region of ribs and spine in visual evaluation. While spatial resolution is somewhat lower than in the original acMoCo reconstructions the motion patterns appear to be more consistent with the expected patterns.

CONCLUSION

The proposed RPCA-guided acMoCo approach successfully suppresses the non-physiological ribs and spine movements in patient data, without relying on segmentation.

CLINICAL RELEVANCE/APPLICATION

A correct estimation of the tumor motion can significantly improve the accuracy of treatment planning in radiation therapy.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

MSRO33

BOOST: Gastrointestinal Hepatobiliary-Science Session with Keynote

Tuesday, Nov. 27 1:30PM - 2:30PM Room: S103AB

GI RO OI

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Tarita O. Thomas, MD, PhD, Chicago, IL (*Moderator*) Nothing to Disclose
Michael F. Bassetti, MD, Madison, WI (*Moderator*) Research Grant, Merck KGaA; Research Grant, AstraZeneca PLC;

Sub-Events

MSRO33-01 Invited Speaker:

Tuesday, Nov. 27 1:30PM - 1:40PM Room: S103AB

Participants
Michael F. Bassetti, MD, Madison, WI (*Presenter*) Research Grant, Merck KGaA; Research Grant, AstraZeneca PLC;

MSRO33-02 Imaging Response Assessment and Outcomes in Hepatocellular Carcinoma after Stereotactic Body Radiotherapy: iRECIST as a Potential Substitute for Traditional Criteria

Tuesday, Nov. 27 1:40PM - 1:50PM Room: S103AB

Participants
Federica Vernuccio, MD, Palermo, Italy (*Presenter*) Research support, Siemens AG
Devon J. Godfrey, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Hannah Vernia, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Mathias Meyer, Durham, NC (*Abstract Co-Author*) Researcher, Siemens AG; Researcher, Bracco Group
Donna Niedzwiecki, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Manisha Palta, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Daniele Marin, MD, Durham, NC (*Abstract Co-Author*) Research support, Siemens AG

For information about this presentation, contact:

federicavernuccio@gmail.com

PURPOSE

To compare imaging response assessment criteria in hepatocellular carcinoma (HCC) treated with stereotactic body radiotherapy (SBRT), and to determine which of these criteria better predicts patient survival.

METHOD AND MATERIALS

In this multicenter retrospective IRB-approved, HIPAA-compliant study, we included 56 HCC lesions (mean size 3.1 cm±1.4) treated with SBRT in 45 patients (age 66.73±7.61; 32 M; 13 F) between 2009 -2017. All patients underwent diagnostic CT/MR imaging within 6 weeks pre-SBRT and at least once 1-6 months post-SBRT. Tumor response on pre- and post-SBRT CT/MR over all assessments was determined using RECIST (response Evaluation Criteria in Solid Tumors) version 1.1, iRECIST (immune-RECIST), WHO (World Health Organization), mRECIST (modified RECIST) and EASL (European Association for the Study of Liver) criteria. Each response criteria was used to classify lesions as responders (i.e. local control: stable disease, partial or complete response) or nonresponders (progressive disease). McNemar's test was used to compare proportions of responders by each method vs RECIST 1.1 assuming independence of lesions. The Kaplan-Meier method was used to estimate 1-year overal survival (OS) from SBRT by each method.

RESULTS

Median follow-up was 19 months (3-29 months). Lesion response rates were 80.4% (n=45) by RECIST 1.1, 94.6% (n=53) by iRECIST, 67.9% (n=36) by WHO, 76.8% (n=43) by mRECIST, 71.4% (n=40) by EASL. Compared to RECIST 1.1, lesion response rate was significanly higher with iRECIST (p=0.005) and lower with WHO (p=0.02). Pseudoprogression occurred in 3 lesions (5%) with RECIST 1.1, 0 (0%) with iRECIST, 5 (9%) with WHO, 4 (7%) with mRECIST, and 7 (12.5%) with EASL. The largest difference in 1-year OS was observed for RECIST 1.1 with longer survival in responders (85%, 90% CI:72-93%) vs non-responders (67%, 90% CI: 35-86%). No differences were found for mRECIST, WHO or EASL. Too few events occurred to assess OS for iRECIST.

CONCLUSION

SBRT is an effective local treatment for HCC. RECIST 1.1 identifies patients with better outcomes; yet iRECIST appears to be promising in overcoming pseudoprogression. Further analysis of association between RECIST 1.1, iRECIST and outcomes are needed.

CLINICAL RELEVANCE/APPLICATION

Response assessment of HCC after SBRT by RECIST 1.1 may be superior to other imaging criteria; however, pseudoprogression

occurs with all of these criteria, except with iRECIST.

MSRO33-03 Stereotactic Body Radiotherapy (SBRT) Utilized as a Bridge to Orthotopic Liver Transplant (OLT) in Patients with Hepatocellular Carcinoma (HCC) and Severe Hepatic Cirrhosis

Tuesday, Nov. 27 1:50PM - 2:00PM Room: S103AB

Participants
Steven D. Gresswell, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Rachel Tobillo, Boca Raton, FL (*Presenter*) Nothing to Disclose
Shaakir Hasan, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Tadahiro Uemura, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Lorenzo Machado, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Ngoc Thai, MD,PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Alexander V. Kirichenko, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To report outcomes on SBRT as a bridging treatment to OLT for patients with HCC and Child-Pugh (CP) score >=8 hepatic cirrhosis.

METHOD AND MATERIALS

Twelve patients, 17 HCC lesions, within Milan criteria for liver transplant who completed liver SBRT prior to OLT from 2010-2017 were retrospectively analyzed. 4D-CT and SPECT imaging were used to facilitate functional treatment planning.

RESULTS

The median age was 60 years (range 48-69 yrs), with a median CP 9 (range 8-11) and MELD-Na 14 (range 9-24). Main cause of cirrhosis was hepatitis C. Three patients required downsizing to be listed within Milan criteria for transplant. The median SBRT dose was 40 Gy in 5 fractions (range 30-50 Gy in 4-6 fractions). The median tumor max dimension was 2.3 cm (range 1.3-5.2 cm). The median PTV size was 37.5 cc (range 9-164 cc). Two patients had a prior TACE. The median time from SBRT to OLT was 5 mos (range 2-10 mos). All patients in the study received planned SBRT prior to OLT. One patient succumbed to progression of hepatic cirrhosis before OLT. The median follow-up and survival was 40 mos (range 3-70 mos) and 46 mos (range 3-70 mos), respectively. Local control was 100%. One patient progressed distantly at 38 mos, with no patients recurring in the liver. The median decrease in size of the HCC lesion was 60%, with five lesions having complete radiographic response by mRECIST criteria. Out of 5 patients who had elevated pretreatment AFP, 4 normalized by 6 mos. Five patients out of the 11 transplanted (45%) had a pathologic complete response on explanted liver. Acute toxicities (CTCAE v4.03) were two Grade 1 gastrointestinal and six Grade <=2 fatigue. No patients were diagnosed with RILD, however 4 patients had grade <=2 elevation of their liver enzymes. The median time to progression of CP > 2 was 9.7 mos (range 7 days-10 mos) while MELD-Na progression leading to an increased 3-month mortality was not met before OLT.

CONCLUSION

Based on our retrospective study we suggest, that SBRT with functional treatment planning can be used safely as a bridging treatment to OLT in select patients with severe cirrhosis meeting Milan criteria for liver transplant

CLINICAL RELEVANCE/APPLICATION

This paper demonstrates promising efficacy and toxicity results in one of the largest series of select patients with severe (Child Pugh $\geq$ 8) cirrhosis treated with SBRT with functional treatment planning for tumor downsizing prior to OLT.

MSRO33-04 Liver Radiomics Using Sulfur Colloid SPECT/CT for Survival Prediction in Primary Liver Cancer Patients Treated with Radiation Therapy

Tuesday, Nov. 27 2:00PM - 2:10PM Room: S103AB

Participants
Stephanie K. Schaub, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Landon Wootton, PHD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Daniel S. Hippe, MS, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company; Research Grant, Canon Medical Systems Corporation; Research Grant, Siemens AG
Stephen R. Bowen, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Art Chaovalitwongse, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Paul E. Kinahan, PhD, Seattle, WA (*Abstract Co-Author*) Research Grant, General Electric Company; Co-founder, PET/X LLC
Tobias R. Chapman, MD, Boston, MA (*Abstract Co-Author*) Consultant, Medtronic plc;
Smith Apisarnthanarax, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Matthew J. Nyflot, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

skschaub@uw.edu

PURPOSE

A critical need in radiotherapy (RT) for primary liver cancer patients is to accurately predict those at risk for toxicity and mortality. We hypothesize that radiomic signatures of the uninvolved liver extracted from pre-treatment functional liver imaging with [99mTc]sulfur colloid (SC) SPECT/CT can improve overall survival (OS) prediction compared with clinical factors alone.

METHOD AND MATERIALS

We retrospectively reviewed 48 primary liver cancer patients with underlying cirrhosis treated with RT for clinical data, including Child-Pugh (CP) score and gross tumor volume (GTV). 30 radiomic features were extracted from pretreatment SC SPECT/CT of the uninvolved liver (histogram, Haralick, neighborhood difference, and zone size features). Cox models were used for univariate and multivariate analysis of OS. Univariate p-values were not adjusted for multiple comparisons. The LASSO was used to construct multivariate models (<=4 variables). Initial model performance was estimated by the apparent c-index (Capp) and models were internally validated with the .632 bootstrap (C.632).

RESULTS

Twelve patients (25%) had CP-B8+ cirrhosis, and median GTV was 10 cc3 [1.2-1573]. 18 died over median follow-up of 13 months. The strongest univariate predictors of OS were GTV (hazard ratio (HR) 2.6, p<0.001) and CP score (HR 1.7, p=0.027), and 9 radiomic features had p<0.05 after adjusting for the strongest predictor (GTV). Multivariate LASSO-Cox performance was Capp=0.75 for GTV, 0.64 for CP score, 0.65 for radiomics, and 0.83 for GTV+CP+radiomics. After internal validation, GTV (C.632 =0.76) and CP models (C.632 =0.64) retained predictive accuracy. However, the radiomics model was not predictive (C.632=0.55, p=0.34) and the GTV+CP+radiomics model was not superior to GTV alone (C.632=0.76, p=0.82).

CONCLUSION

Tumor volume, and to a lesser extent CP score, appear to predict overall survival in primary liver cancer patients. Univariate analysis suggested radiomic features of SC SPECT/CT may provide complementary information beyond GTV and CP score; however, their inclusion did not improve model performance. Prospective validation in a clinical trial is underway.

CLINICAL RELEVANCE/APPLICATION

SC SPECT/CT functional liver radiomics may complement clinical factors to predict survival in primary liver cancer patients for precision radiotherapy that improves outcomes and reduces toxicity.

MSRO33-05 Robotic Stereotactic Radiotherapy for Liver-only Oligometastastic Colorectal Cancer: Single Center Experience

Tuesday, Nov. 27 2:10PM - 2:20PM Room: S103AB

Participants
Lorenzo Livi, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Pierluigi Bonomo, Florence, Italy (*Presenter*) Nothing to Disclose
Marco Vernaleone, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Vanessa Di Cataldo, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Giulio Francolini, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Isacco Desideri, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Daniela Greto, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Emanuela Olmetto, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesca Terziani, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Icro Meattini, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Laura Masi, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

l.livi@dfc.unifi.it

PURPOSE

To report on the safety and clinical benefit of robotic stereotactic body radiotherapy for liver-only oligometastatic colorectal cancer.

METHOD AND MATERIALS

Robotic stereotactic radiotherapy (SBRT) with Cyberknife was applied to oligometastatic colorectal cancer patients defined as having 1-4 liver metastases and absent or controlled extrahepatic disease. The intended prescription dose was 37,5 Gy in 3 fractions, prescribed to the 70% isodose line to cover 95% of the PTV, and adapted if risk-related. Liver - implanted fiducials allowed for tumor tracking during delivery. Treatment efficacy was estimated by clinical benefit rate (CBR), progression free survival (PFS) and overall survival (OS). Toxicity was graded according to CTCAE v. 4.03. Regression analysis was performed to establish whether any correlation could be found between treatment efficacy and biologically effective dose (BED), number of metastatic lesions, number of treated lesions, site of primary tumor, presence of extrahepatic disease and number of lines of systemic treatment.

RESULTS

Between 2012 and 2017, 38 patients (66 lesions) were irradiated. The median delivered biological effective maximum dose (maxBED10) was 142 Gy. At a median follow-up of 11.8 months (range 3.2-58.8), the 1 and 2-year OS were 67.3% and 44.1%, respectively.Local relapse or distant progression occurred in 28 (77,8%) patients, with a 1 and 2-year PFS of 19.3% and 12.2%, respectively. The CBR was 71,4%, with no significant association with max BED10. Age at SBRT > 76 ys and presence of extrahepatic disease had a significant impact on PFS, the latter confirmed at univariate and multivariate analyses. In addition, extrahepatic disease and number of metastatic lesions > 3 had a significant impact on OS, both of which significant at univariate analysis. Mean time of local or distant progression was 4,7 months (SD 3.7). No acute grade 3 gastrointestinal (GI) toxicity was observed.

CONCLUSION

Our results underline the importance of patients' selection to identify the oligo-metastatic scenario most likely to benefit from SBRT. Prospective studies are needed to further assess the role of SBRT among loco-regional treatment options for liver metastases from colorectal cancer.

CLINICAL RELEVANCE/APPLICATION

Our retrospective single center experience adds to the limited available evidence on the promising efficacy and tolerability of SBRT for liver metastases from oligometastatic colorectal cancer

MSRO33-06 Preliminary Clinical Study of Biliary Tract Irradiation Stent for Hilar Cholangiocarcinoma with Malignant Obstructive Jaundice

Tuesday, Nov. 27 2:20PM - 2:30PM Room: S103AB

Participants

Ju Gong, Shanghai, China (*Presenter*) Nothing to Disclose

PURPOSE

To evaluate the efficacy and safety of biliary stent loaded with 125I seeds in treatment of hilar cholangiocarcinoma with malignant obstructive jaundice.

METHOD AND MATERIALS

Totally 43 patients with malignant obstructive jaundice caused by cholangiocarcinoma were included. All the paitents were underwent percutaneous transhepatic puncture ,of, the left and right side branch of the bile duct. In the hilar stenosis, the biliary stent with 125I seeds were implanted, and the biliary drainage tube had been kept in 3 to 5 days after procedures. The drainage tube was removed and the puncture road was closed after the patency of stents were confirmed by cholangiography. The changes of liver function before and after procedures were recorded, and the survival time was observed.

RESULTS

Five biliary stents loaded with 125I seeds were implanted in typeI (n=5), 36 in type II (n=18), 8 in typeIII (n=4) and 25 in typeIV (n=16). The Serum total bilirubin and direct bilirubin of paitents before procedures were (145.5 ±65.3) μmol/L and (124.7±35.0) μmol/L respectively, and (65.9±29.4) μmol/L and (35.5±15.1) μmol/L respectively after procedures. Compared with preoperative, the alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, C-reactive protein and gamma glutamic transaminase decreased significantly (all $P<0.05$); and the lactate dehydrogenase increased significantly ($P=1.05$). The median survival time was 13 months (3.0 to 22.5 months). The serious complications such as biliary puncture, pancreatitis, severe biliary tract infection or biliary bleeding were not occurred.

CONCLUSION

Biliary stent loaded with 125I seeds is an effective therapy to alleviate symptoms of jaundice and prolong the survival time of patients with malignant obstructive jaundice caused by hilar cholangiocarcinoma.

CLINICAL RELEVANCE/APPLICATION

To evaluate the efficacy and safety of biliary stent loaded with 125I seeds in treatment of hilar cholangiocarcinoma with malignant obstructive jaundice.

MSRO37

BOOST: Lung, Mediastinum and Pleura

Tuesday, Nov. 27 1:30PM - 2:30PM Room: S103CD

BQ CH CT NM OI RO

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Meng X. Welliver, MD, Columbus, OH (*Moderator*) Nothing to Disclose
Tracy M. Sherertz, MD, San Francisco, CA (*Moderator*) Nothing to Disclose

Sub-Events

MSRO37-01 Dynamic Perfusion Area-Detector CT versus Dynamic Perfusion MR Imaging versus FDG-PET/CT: Capability for Therapeutic Outcome Prediction in Small Cell Lung Cancer Patients with Limited Disease

Tuesday, Nov. 27 1:30PM - 1:40PM Room: S103CD

Participants
Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Presenter*) Research Grant, Canon Medical Systems Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Fuji Pharma Co, Ltd; Research Grant, Guerbet SA;
Yasuko Fujisawa, MS, Otawara, Japan (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Masao Yui, Otawara, Japan (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Yuji Kishida, MD,PhD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinichiro Seki, Kobe, Japan (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Takeshi Yoshikawa, MD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Noriyuki Negi, RT, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Katsusuke Kyotani, RT,MSc, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Takamichi Murakami, MD, PhD, Osakasayama, Japan (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

yosirad@kobe-u.ac.jp

PURPOSE

To directly compare the capability for therapeutic outcome prediction among dynamics contrast-enhanced (CE-) perfusion area-detector CT (ADCT) and CE-perfusion MR imaging (MRI) assessed by same mathematical method and FDG-PET/CT in small cell lung cancer (SCLC) patients assessed as limited disease (LD).

METHOD AND MATERIALS

Forty-three consecutive pathologically diagnosed SCLC patients assessed as LD (25 male, 18 female; mean age 67 year old) underwent FDG-PET/CT, dynamic CE-perfusion ADCT and MRI, chemoradiotherapy, and follow-up examination. In each patient, therapeutic outcomes were assessed as therapeutic effect based on RECIST guideline, disease free interval and overall survival. Then, all patients were divided into two groups as follows: 1) responder (CR+PR: n=33) and 2) non-responder (SD+PD: n=10) groups. In each patient, total perfusion (TP) and tumor perfusions from pulmonary (TPP) and systemic (TPS) circulations calculated by dual-input maximum slope method from dynamic CE-perfusion ADCT and MRI data and SUVmax on PET/CT were assessed at targeted lesions. Then, final values were determined as average values from all targeted lesion, and compared between two groups by Student's t-test. To compare the capability for distinguishing two groups, all indexes as having significant difference were assessed by ROC analysis. Finally, disease free and overall survivals between responders and non-responders assessed by each index were compared by Kaplan-Meier method followed by log-rank test.

RESULTS

There were significant difference of all indexes except TPP determined by each method ($p<0.05$). Area under the curves (Azs) of TPS (ADCT: Az=0.92, MRI: Az=0.92) were significantly larger than that of SUVmax (Az=0.73, $p<0.05$). Disease free survivals of responder were significantly longer than that of non-responder by TP (ADCT: p=0.006, MRI: p=0.02) and TPS (ADCT: p=0.001, MRI: p=0.02). Overall survivals of responder were also significantly longer than that of non-responder by TP (ADCT: $p<0.0001$, MRI: p=0.0003,) and TPS (ADCT: p=0.001, MRI: p=0.001).

CONCLUSION

Dynamic CE-perfusion ADCT and MRI have better potential for predicting therapeutic outcome than FDG-PET/CT in small cell lung cancer patients with limited disease.

CLINICAL RELEVANCE/APPLICATION

Dynamic CE-perfusion ADCT and MRI have better potential to predict therapeutic outcome than FDG-PET/CT in small cell lung cancer patients with limited disease.

MSRO37-02 Modern Treatment Patterns and Overall Survival of Non-Small Cell Lung Cancer Patients Receiving Palliative Radiation Therapy for Brain Metastases at Diagnosis

Tuesday, Nov. 27 1:40PM - 1:50PM Room: S103CD

Awards
Student Travel Stipend Award

Participants
Pamela Samson, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Benjamin W. Fischer-Valuck, MD, MS, St. Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Prashant Gabani, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Michael C. Roach, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Jeffrey D. Bradley, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Cliff G. Robinson, MD, Saint Louis, MO (*Abstract Co-Author*) Investigator, Varian Medical Systems, Inc; Research funded, Varian Medical Systems, Inc; Speakers Bureau, Varian Medical Systems, Inc; Research funded, Elekta AB; Travel support, Merit Medical Systems, Inc; Speakers Bureau, ViewRay, Inc; Stockholder, Radialogica, LLC
Christopher D. Abraham, MD, Manchester, MO (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

psamson@wustl.edu

PURPOSE

Non-small cell lung cancer (NSCLC) is one of the most common malignancies associated with brain metastases (BM) at diagnosis. Recent randomized trials have shown equivalent survival outcomes and improved neurocognitive outcomes with stereotactic radiosurgery (SRS) compared to whole brain radiation therapy (WBRT). We reviewed the NCDB to identify trends of RT for NSCLC patients with BM.

METHOD AND MATERIALS

11,299 NSCLC patients with BM at diagnosis and treated with palliative brain RT between 2010 and 2014 were identified in the NCDB. Patients receiving "stereotactic radiosurgery, NOS," "LINAC radiosurgery," or "gamma knife radiosurgery," or received external-beam RT with fraction size >=6 Gy were included in the SRS cohort. The WBRT cohort included all patients receiving RT to the brain in >=5 fractions. Patient characteristics were correlated with treatment received using multivariable logistic regression. Kaplan-Meier was used to compare overall survival (OS) between these two groups and Cox Proportional Hazards modeling (CPHM) to identify variables associated with OS.

RESULTS

9,680 (85.7%) patients were included in the WBRT group and 1,619 (14.3%) patients in the SRS group. Median dose in the WBRT was 3000 cGy and 2200 cGy in the SRS group. The frequency of SRS increased from 9.9% in 2010 to 19.6% in 2014. On MVA, variables associated with increased likelihood of receiving SRS included: increasing age (OR 1.01, 95% CI 1.01-1.02; P<0.0001), most recent year (2014) of diagnosis (OR 2.14, 1.78-2.56; P<0.0001), treatment at an academic facility (OR 3.21, 2.51-4.10; P<0.0001), private insurance (OR 2.25, 1.62-3.11), income in zip code >$63,000 (OR 1.33, 1.13-1.56; P=0.001), living >20 miles from treatment facility (OR 1.19, 1.03-1.37; P=0.016), and receipt of chemotherapy (OR: 2.48, 2.12-2.88; P<0.0001). WBRT patients had median OS of 4.1 months (95% CI, 4.0-4.3) vs. 8.9 months (8.2-9.7) for SRS patients (P<0.0001). On CPHM, factors independently associated with improved OS included receipt of SRS, chemotherapy, treatment at an academic center, and private insurance (P<0.02 for all).

CONCLUSION

Our analysis reveals that WBRT remains the most common palliative treatment for BM in NSCLC. SRS use is increasing and has nearly doubled between 2010 and 2014. In this study, SRS was associated with increased OS although there are biases in the selection of patients who receive SRS.

CLINICAL RELEVANCE/APPLICATION

SRS use for NSCLC patients with BM at the time of diagnosis is increasing, and is independently associated with improved OS.

MSRO37-03 Quantification of Radiation Pneumonitis in Lung Cancer Patients Receiving Proton or Photon Radiotherapy Using FDG-PET/CT

Tuesday, Nov. 27 1:50PM - 2:00PM Room: S103CD

Awards
Trainee Research Prize - Fellow

Participants
Pegah Jahangiri, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Kamyar Pournazari, MD,MSc, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Charles B. Simone II, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Drew A. Torigian, MD, MA, Philadelphia, PA (*Abstract Co-Author*) Co-founder, Quantitative Radiology Solutions LLC
Abass Alavi, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

pegah.jahangiri@uphs.upenn.edu

PURPOSE

This study assessed the feasibility of FDG-PET/CT to quantify radiation-induced pneumonitis in ipsilateral and contralateral lungs of patients with locally advanced non-small cell lung cancer (NSCLC) who received proton, photon, or combined proton-photon radiotherapy (RT).

METHOD AND MATERIALS

39 consecutive patients (53.8% female, median age 67y) with predominantly stage IIIA (62%) or IIIB (31%) NSCLC underwent FDG-PET/CT before and after proton or photon RT. Regions of interest (ROIs) were drawn manually along the margins of the lung parenchyma on PET/CT images. Lung mean standardized uptake value (SUVmean), global lung glycolysis (GLG), and lung volume were measured. Partial volume correction (PVC) of PET-based parameters was then performed. To quantify tumor metabolic response to RT, metabolically active tumor volume (MTV), tumor SUV, and total lesion glycolysis (TLG) were measured. Total lesion glycolysis was then subtracted from GLG to calculate global lung parenchymal glycolysis (GLPG). Parameters of FDG-PET/CT scans before and after RT were compared using two-tailed paired t-tests.

RESULTS

Among the 9 patients who received photon RT, there was a significant increase in PVC-GLPG of ipsilateral ($p < 0.001$) and in GLG of contralateral ($p = 0.036$) lungs. Also, in the subset of 9 patients who received combination of proton-photon RT, there was a statistically significant increase in PVC-GLPG in only the ipsilateral lung ($p < 0.001$). In contrast, among the 21 patients treated exclusively with proton RT, no significant increase in PVC-SUVmean ($p=0.114$) or in PVC-GLPG ($p=0.453$) were observed in ipsilateral lungs. Also, there were no significant increase in SUVmean ($p=0.841$) or in GLG ($p=0.241$) of contralateral lungs of patients who received exclusively proton RT.

CONCLUSION

We identified significant increases in PVC-SUV and PVC-GLPG in patients who received photon RT (either alone or in combination with proton RT) that were not identified in patients who received only proton RT. These observations suggest less induction of inflammatory response in both ipsilateral and contralateral lungs of patients treated with proton compared to photon or combined proton-photon RT, suggesting a mechanism by which proton therapy reduces radiation-induced pneumonitis.

CLINICAL RELEVANCE/APPLICATION

Proton RT induces less inflammatory response in both the ipsilateral and contralateral lungs of patients compared to photon or combined proton-photon RT.

MSRO37-04 Differentiating EGFR Mutation Status in Non-Small Cell Lung Cancer Using Imaging Features From PET/CT

Tuesday, Nov. 27 2:00PM - 2:10PM Room: S103CD

Participants
Mengmeng Jiang, Shanghai, China (*Presenter*) Nothing to Disclose
Yiqian Zhang, MS, Shanghai, China (*Abstract Co-Author*) Employee, Shanghai United Imaging Healthcare Co, Ltd
Min Ji, Shanghai, China (*Abstract Co-Author*) Employee, Shanghai United Imaging Healthcare Co, Ltd
Junshen Xu, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Jiyong Wang, MSc, Jiading, China (*Abstract Co-Author*) Researcher, Shanghai United Imaging Healthcare Co, Ltd
Nan-Jie Gong, Houston, TX (*Abstract Co-Author*) Employee, UIH America, Inc
Qiang Li, PhD, Shanghai, China (*Abstract Co-Author*) Employee, Shanghai United Imaging Healthcare Co, Ltd
Xiuzhong Yao, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In this study, we investigated whether epidermal growth factor receptor (EGFR) mutation status in non-small cell lung cancer (NSCLC) can be assessed from quantitative as well as qualitative features extracted from both CT and PET.

METHOD AND MATERIALS

Eighty patients with stage II and III NSCLC and a confirmed EGFR mutation status (30 patients were positive and 50 were negative for EGFR mutation), who underwent PET/CT between January 2017 to December 2017, were included in this study. We extracted 514 quantitative features from PET/CT (257 for PET and 257 for CT) and 12 qualitative features from CT. Principal component analysis (PCA) was applied for feature selection. We selected principal components retaining 95% of the variability from all features. We then rebuilt the original features using the selected principal components and the original features were selected that correlated by at least 99% to the rebuilt features. Finally, 5 qualitative features, 24 quantitative features for CT as well as 10 quantitative features for PET were selected. A predictive model of EGFR mutation in terms of selected features using generalized linear regression with lasso regularization. The regularization parameter was selected through a 10-fold cross validation. All statistical analysis were performed in R software version 3.4.4.

RESULTS

With the total of 39 features selected which were significantly associated with EGFR mutation status, a predictive model for associating image features with EGFR positive/negative was built. We estimated the performance of the model using the area under the receiver operating characteristic curve (AUC). The result revealed an AUC=0.74.

CONCLUSION

By combing the PET-CT images together with first generation gene testing data, we investigate the relationship between image features and EGFR mutation status and built a radiogenomics model which can predict whether the patients have EGFR mutation or not from a certain number of qualitative features as well as quantitative features.

CLINICAL RELEVANCE/APPLICATION

A non-invasive method from image features to predict gene mutation status correlated with NSCLC and further advancing the role of imaging in precision medicine.

MSRO37-05 Stereotactic Body Radiotherapy for Centrally Located Non-Small Cell Lung Cancer: Single Center Experience

Tuesday, Nov. 27 2:10PM - 2:20PM Room: S103CD

Participants

Lorenzo Livi, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Pierluigi Bonomo, Florence, Italy (*Presenter*) Nothing to Disclose
Vieri Scotti, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Marco Perna, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Luca Visani, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Gabriele Simontacchi, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Vanessa Di Cataldo, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Isacco Desideri, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Daniela Greto, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Giulio Francolini, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Laura Masi, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose
Stefania Pallotta, MS, Florence, Italy (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

l.livi@dfc.unifi.it

PURPOSE

By definition, centrally located lung tumors are identified as a lesion located within 2 cm or touching the zone of the proximal bronchial tree or tumors immediately adjacent to the mediastinal or pericardial pleura. In these cases, the use of stereotactic body radiotherapy (SBRT) is debated due to the potential risk of severe toxicity. Currently, no high-level evidence is available to support its use.

METHOD AND MATERIALS

Between 2010 an 2015, 40 patients were treated with SBRT for 45 centrally located lesions. SBRT was delivered through either a LINAC-based intensity modulated radiotherapy (IMRT) technique or a robotic technique with Cyberknife. The prescribed total dose varied between 26 and 60 Gy delivered in 1 or 8 fractions, respectively, with median BED10 of 69 Gy (range 37,5-105 Gy). Overall Survival (OS) and Progression Free Survival (PFS) were reported using Kaplan-Meier method. Treatment-related toxicity was evaluated according to CTCAE version 4.0

RESULTS

The median age of the cohort was 62 years (48-86). The majority of treated lesions were secondary hilar or mediastinal lymphadenopathies (31/45, 69%), while unresectable primary tumors represented the remaining 14 cases (14/45, 31%). The most commonly used technique was VMAT for 21 lesions (47%), followed by Cyberknife for 14 (31%) and step and shoot IMRT for 10 targets (22%), respectively. The predominant NSCLC histology was adenocarcinoma (32/45, 71%). The median longest tumor diameter was 31 mm (range 10-60 mm). At a median follow-up of 14.5 months, OS and PFS were 86.5%, 55.6%, 49.4% and 48.6%, 24.1% and 12% at 1, 2 and 3 years, respectively. According to RECIST 1.1 criteria, a clinical benefit was achieved for 23 patients (57.5%) with a complete or partial response or stable disease in 4 (10%), 15 (37.5%) and 4 (10%) patients, respectively. Consistent with previous experiences using the same fractionation regimens, SBRT was well tolerated, with no G3/G4 toxicities: the most severe side effect was G2 esophagitis in 5/40 patients (12.5%).

CONCLUSION

In accordance with standardized risk-dose prescriptions, the use of SBRT for centrally located NSCLC was confirmed to be a safe and effective strategy. Prospective studies are warranted to support its use with high level evidence.

CLINICAL RELEVANCE/APPLICATION

Our single-center experience adds to the limited available evidence on the feasibility and clinical benefit of SBRT for centrally located NSCLC

MSRO37-06 Evaluation of the Tumor Response Using FDG-PET/CT Scans in Non-Small Cell Lung Cancer Patients Treated with Proton or Photon Radiotherapy

Tuesday, Nov. 27 2:20PM - 2:30PM Room: S103CD

Participants
Pegah Jahangiri, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Kamyar Pournazari, MD,MSc, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Charles B. Simone II, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Drew A. Torigian, MD, MA, Philadelphia, PA (*Abstract Co-Author*) Co-founder, Quantitative Radiology Solutions LLC
Abass Alavi, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

pegah.jahangiri@uphs.upenn.edu

PURPOSE

Lung cancer is one the leading causes of death worldwide. Radiation therapy (RT) is a major treatment option for lung cancer, including for unresectable locally advanced non-small cell lung cancer (LA-NSCLC). The aim of this study was to evaluate the response of the primary lung tumor to proton versus photon RT using 18F-fluorodeoxyglucose (FDG)-PET/CT in patients with LA-NSCLC.

METHOD AND MATERIALS

Thirty-nine consecutive patients who underwent FDG-PET/CT imaging pre- and post- proton or photon RT were assessed. Patients were predominantly female (53.8%) with a median age of 67 years and with predominantly stage IIIA (62%). An adaptive contrast-oriented thresholding algorithm was applied to measure metabolically active tumor volumes, uncorrected SUV, partial volume corrected SUV and total lesion glycolysis. Parameters of FDG-PET/CT scans before and after RT were compared using two-tailed paired t-tests.

RESULTS

Among the 9 patients who received photon RT and the 9 patients who received a combination of proton-photon RT, there was a significant decrease in PVC-TLG. Interestingly, among the 21 patients treated exclusively with proton RT, all tumor parameters including MTV, SUVmax, uncorrected SUVmean, PVC-SUVmean, uncorrected TLG, and PVC-TLG after treatment decreased significantly (all $p < 0.001$). The decreases in PVC-TLG and tumor PVC-SUVmean were more obvious than non-PVC ones (ΔPVC-TLG -357.26 cc versus ΔTLG -252.92 cc; ΔPVC-SUVmean -16.2 versus ΔSUVmean -10.19).

CONCLUSION

Adaptive contrast-oriented thresholding algorithm is a promising method to quantify whole tumor glycolysis in LA-NSCLC, and our findings demonstrates that proton RT is as effective as photon RT metabolically in inducing tumor response of LA-NSCLC.

CLINICAL RELEVANCE/APPLICATION

Proton RT, which is much safer, is as effective as photon RT in treatment of LA-NSCLC.

MSRO34

BOOST: Gastrointestinal-Case-based Multidisciplinary Review (Interactive Session)

Tuesday, Nov. 27 3:00PM - 4:15PM Room: S103AB

GI OI RO

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants

Smith Apisarnthanarax, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Jeff L. Weinstein, MD, Boston, MA (*Presenter*) Nothing to Disclose
James O. Park, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Tobias R. Chapman, MD, Boston, MA (*Presenter*) Consultant, Medtronic plc;

LEARNING OBJECTIVES

1) Differentiate between the various local treatment modalities (surgical, transarterial, thermal ablation, SBRT, proton beam therapy) used in the treatment of liver tumors (HCC, cholangiocarcinoma, metastasis) 2) Describe various advantages and disadvantages/limitations of each locoregional therapeutic modality 3) Appraise different clinical scenarios and select appropriate local therapy options based on specific technical and patient related factors

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

MSRO38

BOOST: Lung-Case-based Multidisciplinary Review (Interactive Session)

Tuesday, Nov. 27 3:00PM - 4:15PM Room: S103CD

CH OI RO

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants
Simon S. Lo, MD, Seattle, WA (*Presenter*) Editor, Springer Nature;
Subba R. Digumarthy, MD, Boston, MA (*Presenter*) Nothing to Disclose
Feng-Ming Kong, MD,PhD, Cleveland, OH (*Presenter*) Speakers Bureau, Varian Medical Systems, Inc
Jyoti D. Patel, MD, Chicago, IL (*Presenter*) Nothing to Disclose
David W. Johnstone, Milwaukee, WI (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

simonsmlo@gmail.com

sdigumarthy@mgh.harvard.edu

djohnstone@mcw.edu

LEARNING OBJECTIVES

1) Discuss the appropriate management of non-small cell lung cancer. 2) Discuss the appropriate management of small cell lung cancer.

ABSTRACT

Modern management of lung cancer typically involves interdisciplinary evaluation by radiologists, thoracic surgeons, medical oncologists, and radiation oncologists. This session reviews the most up-to-date multidisciplinary management of both non-small cell and small cell lung cancer through clinical cases.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Subba R. Digumarthy, MD - 2013 Honored Educator

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

SSJ23

Physics (CT: Cone-Beam CT in Imaging and Radiation Therapy)

Tuesday, Nov. 27 3:00PM - 4:00PM Room: N226

CT PH RO

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Joseph W. Stayman, PhD, Baltimore, MD (*Moderator*) Research Grant, Canon Medical Systems Corporation; Research Grant, Carestream Health, Inc; Research Grant, Elekta AB; Research collaboration, Fischer Medical; Research Grant, Medtronic plc; Research collaboration, Koninklijke Philips NV; Research Grant, Siemens AG
Cem Altunbas, PhD, Aurora, CO (*Moderator*) Nothing to Disclose

Sub-Events

SSJ23-01 Quantitative Extremity Cone-Beam CT Using Model-Based Polyenergetic Reconstruction

Tuesday, Nov. 27 3:00PM - 3:10PM Room: N226

Participants
Qian Cao, Baltimore, MD (*Presenter*) Nothing to Disclose
Alejandro Sisniega, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Carestream Health, Inc
Joseph W. Stayman, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation; Research Grant, Carestream Health, Inc; Research Grant, Elekta AB; Research collaboration, Fischer Medical; Research Grant, Medtronic plc; Research collaboration, Koninklijke Philips NV; Research Grant, Siemens AG
John Yorkston, PhD, Penfield, NY (*Abstract Co-Author*) Employee, Carestream Health, Inc
Jeffrey H. Siewerdsen, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Carestream Health, Inc; Advisory Board, Siemens AG; Advisory Board, Carestream Health, Inc; License agreement, Carestream Health, Inc; License agreement, Precision X-Ray, Inc; License agreement, Elekta AB; ; ;
Wojciech Zbijewski, PhD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Carestream Health, Inc; Research Grant, Siemens AG

For information about this presentation, contact:

qcao@jhmi.edu

PURPOSE

Quantitative evaluation of bone mineral density (BMD) using cone-beam CT (CBCT) is challenged by a high level of artifacts typically associated with CBCT. We apply a polyenergetic model-based iterative reconstruction (MBIR) with a material mixing model to obtain accurate and reproducible density estimates in extremity CBCT.

METHOD AND MATERIALS

An ideal solution model was used in polyenergetic MBIR (MBIR-poly, Elbakri PMB 2003) to account for mixing of Ca and marrow in bone. The model was calibrated using BMD inserts of known concentration (Gammex 467, 472). Scans were acquired at 90 kVp on a test-bench emulating the geometry of extremity CBCT. Monte Carlo scatter estimates obtained from water-corrected FBP were subtracted from projection data. Artifact reduction and quantitative accuracy were evaluated in water phantoms with muscle, adipose and BMD inserts (from 20 mg/cc to 500 mg/cc Ca). MBIR-poly reconstructs the density map of the object and thus the reconstructed voxel values were compared with measured physical densities of the inserts. To assess robustness to imaging conditions (essential in longitudinal studies), we compared density estimates in cortical and trabecular regions-of-interest (ROI) of a cadaveric ankle imaged in the following configurations: ankle alone (C1), ankle+water+2 BMD inserts (C2), ankle+water+2 BMD inserts+2 cm shift (C3).

RESULTS

With MBIR, the error in density was <0.009 g/cc across all BMD inserts. The magnitude of streak artifacts (departure from uniformity in a water region) was reduced by 96% compared to FBP with water-correction only. The spread (standard deviation) of mean cortical and trabecular density across configurations C1-C3 was reduced by 78% and 51%, respectively. The estimates of physical BMD insert density remained accurate when imaged in the presence of the ankle (configurations C2 and C3), with errors<0.015 g/cc.

CONCLUSION

MBIR-poly with an ideal solution mixture model yielded correction of beam hardening artifacts and provided quantitatively accurate estimates of object density in extremity CBCT. The density estimates were reproducible across a variety of imaging conditions.

CLINICAL RELEVANCE/APPLICATION

A polyenergetic model-based reconstruction algorithm yields accurate and reproducible estimates of tissue density in extremity CBCT, enabling quantitative studies of bone mineralization.

SSJ23-02 Two-Dimensional Anti-scatter Grids for CBCT: Transmission Properties of High Grid Ratio 2D Grid

Prototypes

Tuesday, Nov. 27 3:10PM - 3:20PM Room: N226

Participants
Cem Altunbas, PhD, Aurora, CO (*Presenter*) Nothing to Disclose
Timur Alexeev, PhD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
Brian D. Kavanagh, MD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
Moyed Miften, PhD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

caltunbas@gmail.com

PURPOSE

CT number accuracy and low contrast resolution can be poor in CBCT images due to high levels of scattered radiation. To reduce scatter, we have been investigating the utility of 2D antiscatter grids for flat panel detector based CBCT. In this study, we developed two prototypes, and characterized their scatter and primary transmission performance in a CBCT system for image guided radiation therapy.

METHOD AND MATERIALS

Two prototypes with grid ratio of 12 (R12) and 16 (R16) were developed and fabricated by using direct metal laser sintering process. Both grids have 2 mm grid pitch, and 0.1 mm septal thickness, and their grid cells were focused towards the x-ray source, in offset detector CBCT geometry. Prototypes were integrated with the flat panel detector in a clinical CBCT system. Primary and scatter transmission properties were measured using PMMA phantoms and beam-stops, at tube voltages of 80, 125, and 140 kVp. To benchmark the performance of prototypes, a fluoroscopic 1D antiscatter grid with a grid ratio of 21 (R21) was also evaluated under identical imaging conditions.

RESULTS

At 140 kVp, scatter-to-primary ratio (SPR) at 40 cm phantom thickness was 10.1 without a grid. SPR was reduced to 0.36 and 0.29 with our R12 and R16 prototypes, whereas SPR was 1.47 with the 1D grid. Scatter transmission fraction (Ts) with R12 and R16 prototypes were 3.1% and 2.4%, and Ts for 1D grid was 10.8%. When tube voltage increased for 80 to 140 kVp, Ts values increased by 13% for both 2D grids, whereas Ts increased by 31% for the 1D grid. Similar trends were observed for all grids when phantom thickness was varied between 10 and 40 cm. Average primary transmission fraction of R12, R16 prototypes, and 1D grid were 83%, 71%, and 70%, respectively.

CONCLUSION

Scatter transmission of our 2D grids were up to factor of 4.5 lower than a conventional antiscatter grid, while providing higher primary transmission. Thus, lower scatter transmission provided by 2D grids may lead to higher CT number accuracy and improved contrast resolution in CBCT. Lower scatter transmission may also play an important in the context of dual-energy CBCT, where highly accurate projection images are required.

CLINICAL RELEVANCE/APPLICATION

Scattered radiation is one of the leading causes of image quality degradation in CBCT imaging, limiting the utility of CBCT in a range of clinical applications. Our research on 2D antiscatter grid development aims to address this problem.

SSJ23-03 Deep Scatter Estimation (DSE) for Truncated Cone-Beam CT (CBCT)

Tuesday, Nov. 27 3:20PM - 3:30PM Room: N226

Participants
Joscha Maier, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Elias Eulig, BSC, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Stefan Sawall, PhD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Marc Kachelriess, PhD, Heidelberg, Germany (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

joscha.maier@dkfz.de

PURPOSE

To correct for x-ray scatter in truncated CBCT in real time.

METHOD AND MATERIALS

Cone-beam CT (CBCT) acquisitions suffer from scatter artifacts. To correct for these artifacts, we recently developed the deep scatter estimation (DSE) that trains a deep convolutional neural network to reproduce Monte Carlo (MC) scatter estimates. Once trained, DSE combines both real-time capability and high accuracy. Applied to non-truncated data, DSE turned out to be equivalent to MC while outperforming known scatter estimation approaches. In the present work, however, we deal with truncated data as they occur in interventional C-arm CBCT or dental CBCT. In this case MC simulations are not possible because the object, which is needed as input to the MC simulation, cannot be fully reconstructed. To overcome this drawback, we developed the truncated DSE which uses a U-net architecture to reproduce the outcome of MC simulations from non-truncated objects given only the truncated projection data as input. Here, DSE is trained on 10800 simulated truncated projection images (pelvis, abdomen, and thorax). The training is performed on a GeForce GTX 1080 for 100 epochs using an Adam optimizer and the mean absolute error between the output and the MC scatter distribution as loss function. The performance of DSE was evaluated for simulated and measured testing data of a truncated CBCT system and compared against a kernel based scatter estimation (KSE).

RESULTS

Considering simulated data, the accuracy of KSE and DSE scatter estimates was quantified by calculating the mean absolute error (MAE) with respect to the simulated ground truth scatter distribution. Here, we observe a MAE of 19.2 % (KSE) and 1.8 % (DSE).

To quantify the performance for measured data, a slit scan measurement was performed as reference. Compared to the slit scan, CT reconstructions that were corrected using DSE show an almost similar CT value distribution while there are discrepancies of up to 150 HU using KSE.

CONCLUSION

DSE is able to derive highly accurate scatter estimates very close to MC simulations. Compared to conventional scatter estimation approaches DSE shows a superior performance while requiring similar processing time (20 ms / projection).

CLINICAL RELEVANCE/APPLICATION

Scatter correction is crucial to maintain the diagnostic value of CBCT examinations. DSE can overcome the drawback of existing approaches that are optimized for performance at the cost of accuracy.

SSJ23-04 Daily Edge Deformation Prediction Using a Conventional Neural-Network Regression for Low Dose Prior Contour Based Total Variation CBCT Reconstruction (PCTV-CNN)

Tuesday, Nov. 27 3:30PM - 3:40PM Room: N226

Participants
Yingxuan Chen, Durham, NC (*Presenter*) Nothing to Disclose
FangFang Yin, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Ziyi Wang, BEng,BEng, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Lei Ren, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

yingxuan.chen@duke.edu

PURPOSE

Previously we developed a PCTV reconstruction method to enhance the edge sharpness of low-dose CBCT. PCTV deforms the edge map from planning CT to on-board volumes to obtain the on-board edge information for enhancement in TV reconstruction. However, the deformable registration used for deforming the edge is time consuming and prone to errors due to the low quality of CBCT. This study aims to develop a novel method for predicting daily on-board edge deformation using deep conventional neural networks (CNN) to bypass deformable registration to improve the PCTV reconstruction efficiency.

METHOD AND MATERIALS

The new method uses patch-based CNN deformation prediction and PCTV reconstruction. Deformation vector field (DVF) registered from CT to full-sampling CBCTs and retrospectively under-sampled low-dose CBCT are obtained on the first day to train the model, which is then updated with following days' data. The model predicts DVF for low-dose CBCT acquired on the following day to generate on-board contours for PCTV reconstruction. Specifically, 3D patches are extracted from the same location in the planning-CT and low-dose CBCT as the inputs. Only DVF and voxels at the edge regions of planning-CT are selected for the prediction model. The CNN model is developed in MATLAB using 4 convolutional layers interleaved with pooling layers to directly learn the mapping from the input image patch pair. The method is evaluated using lung SBRT patient data. The first n-1 day's CBCTs are used for CNN training to predict nth day edge information (n=2, 3, 4, 5). 45 half-fan projections covering 360° from nth day CBCT is used for reconstruction. Results from Edge-preserving (EPTV), PCTV and PCTV-CNN are compared.

RESULTS

The cross-correlations between predicted and reference edge maps are 0.9734, 0.9706, 0.9624 and 0.9477, for day 2-5 respectively. PCTV-CNN enhanced bone edges in CBCT compared to EPTV and achieved comparable image quality as PCTV while avoiding time-consuming deformable registration process.

CONCLUSION

Preliminary results demonstrated the feasibility to use CNN to predict daily deformation of on-board edge information for PCTV based low-dose CBCT reconstruction.

CLINICAL RELEVANCE/APPLICATION

PCTV-CNN has a great potential for enhancing the edge sharpness with high efficiency for low dose 3D CBCT or 4D CBCT to improve the precision of on-board target localization and adaptive radiotherapy.

SSJ23-05 A Robust Fully Automatic Method for Intrinsic Respiratory and Cardiac Gating for Cone-Beam CT Scans of the Thorax Region

Tuesday, Nov. 27 3:40PM - 3:50PM Room: N226

Participants
Andreas Hahn, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Knaup, PhD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Marc Kachelriess, PhD, Heidelberg, Germany (*Presenter*) Nothing to Disclose

PURPOSE

To automatically extract a respiratory and a cardiac signal from cone-beam CT (CBCT) rawdata.

METHOD AND MATERIALS

Due to the relatively slow acquisition speed of CBCT systems, patient respiration and cardiac motion lead to motion blurring. This can be compensated using motion-compensated image reconstruction in 4D and in 5D [Brehm et al., MedPhys 42(4)] which requires accurate motion information. Without an external signal, motion surrogates have to be retrieved intrinsically from the rawdata. While there are several methods for respiratory gating, only few are dedicated to cardiac gating but are not very robust. We propose a robust method that is able to retrieve a respiratory and a cardiac signal fully automatically. The respiratory signal is retrieved by analyzing the mean signal over the whole detector as a function of the projection angle. The cardiac signal starts from

50×50×50 uniformely distributed grid points in the field of measurement to which x-y-circles of radius r are attached. We iterate over radii between 3 cm and 5 cm in steps of 2 mm and compute the intersection of the x-ray that runs through the tangent of each circle with the detector. The intersection points are centers of rectangular ROIs of about 8 cm by 4 cm whose mean value serves as a surrogate for the cardiac motion phase. The most regular signal after band pass filtering is selected as the cardiac surrogate. The method was tested on 10 patient thorax scans acquired with a Varian True Beam system and compared to the AS method [Van Herk et al., ICCR 07] (M1) and the method of reference [Hahn et al., SPIE Medical Imaging 2016] (M2).

RESULTS

The proposed method, M1 and M2 determined the correct number of respiratory peaks. While the proposed method showed good results for the cardiac gating with a maximum error of 1 heart beat, M2 showed good results for 6 patients (max. error 1), it did not perform well for 4 patients (max. error 23). M1 cannot detect cardiac motion.

CONCLUSION

The proposed method is able to acquire a respiratory and cardiac surrogate in a fully automatic way for CBCT scans of the thorax region and outperformed M2 in terms of robustness.

CLINICAL RELEVANCE/APPLICATION

Clinically, intrinsic gating will be useful in cases where no gating signals are available, such as it is the case in many interventional imaging scenarios. With intrinsic gating those cases can benefit from motion-compensated reconstruction and thus from better image quality.

SSJ23-06 Multi-Structure Segmentation of Hard Tissues, Maxillary Sinus, Mandible, Mandibular Canals in Cone Beam CT of Head and Neck with 3D U-Net

Tuesday, Nov. 27 3:50PM - 4:00PM Room: N226

Participants
Sungwon Ham, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Areum Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jongha Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Younghwa Byeon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sangwook Lee, BS, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Myungsoo Bae, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jae-Woo Park, Incheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Namkug Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Stockholder, Coreline Soft, Co Ltd

For information about this presentation, contact:

namkugkim@gmail.com

PURPOSE

we proposed automatic segmentation method on four facial structures including hard tissues, maxillary sinus, mandible, and mandibular canals using 3D U-Net with convolutional neural net (CNN) in CBCT.

METHOD AND MATERIALS

We obtained 100 data sets of i-Cat CBCT scans (Imaging Science International, Hatfield, PA, USA).The training and validation dataset of hard tissues, maxillary sinus and mandible consists of 7 and 4 cases, 20 and 4 cases, and 20 and 4 cases, respectively. The training, and validation dataset of mandibular canals consist of 40 and 15 cases, respectively. Each test dataset was used in the same 7 patients. Depending on the structures, the segmentation result as gold standard was made differently. The hard tissues and mandibular canals were manually drawn by an expert and confirmed by an expert dentist. The initial mandible and maxillary sinus mask was created by in-house software with conventional image processing techniques including 3D sculpting and thresholding. These masks were filled per slice, and manually corrected by experts. Before training,we pre-processed images to change brightness (window level = 450) and contrast (window width = 5000). Also, the number of each dataset was augmented by flip and rotation. We used the 3D U-Net, one of the most widely used CNN architectures for image segmentation.

RESULTS

For the evaluation metrics, the Dice similarity coefficient (DSC), Jaccard similarity coefficient (JSC), mean surface distance (MSD) and Hausdorff surface distance (HSD) were 82.60±0.04%, 70.47±0.06%, in hard tissues, 86.60±0.01%, and 92.80±0.01%, and 82.00±0.07%, 0.35±0.29mm, 0.49±0.09mm in maxillary sinus, 90.00±0.04 %, 0.89±0.66 %, 11.29±10.21mm, 3.21±2.56mm and 18.42±19.72mm, in mandible, respectively. In the mandibular canals, mean error distances were 0.89±0.40mm.

CONCLUSION

In this study, we proposed an automatic 3D segmentation method, demonstrated very fast segmentation results with reasonable accuracies of multi-facial structures in CBCT including hard tissues, maxillary sinus, mandibular, and mandibular canals.

CLINICAL RELEVANCE/APPLICATION

This study could be used to the planning of dental implant and orthognathic surgeries.

SSJ24

Science Session with Keynote: Radiation Oncology (Gastrointestinal Malignancies)

Tuesday, Nov. 27 3:00PM - 4:00PM Room: E261

GI RO

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Anna Shapiro, MD, Syracuse, NY (*Moderator*) Nothing to Disclose
Tarita O. Thomas, MD, PhD, Chicago, IL (*Moderator*) Nothing to Disclose

Sub-Events

SSJ24-01 Invited Speaker:

Tuesday, Nov. 27 3:00PM - 3:20PM Room: E261

Participants
Tarita O. Thomas, MD, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

SSJ24-03 Dose Escalation with Simultaneous Integrated Boost (SIB) Using 3DCRT and VMAT in Neoadjuvant Radiotherapy of Rectal Cancer: Evaluation of Normal Organ Doses

Tuesday, Nov. 27 3:20PM - 3:30PM Room: E261

Participants
Mustafa Adli, MD, Istanbul, Turkey (*Presenter*) Nothing to Disclose
Ayse Dagli, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose
Funda Ozturk, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose
Hilal Alkis, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

ben1dost@yahoo.com

PURPOSE

To evaluate normal organ doses in rectal cancer patients treated with neoadjuvant radiotherapy using dose escalated SIB with three-dimensional conformal radiotherapy (3DCRT) and volumetric modulated arc therapy (VMAT).

METHOD AND MATERIALS

Treatment planning CT images of 88 rectal cancer patients (F: 31, M: 57) were included. Median patient age was 60 (30-85). Patients with inguinal lymph nodes in the treatment field were excluded. Two treatment plans were done for each patient using SIB with VMAT and 3DCRT techniques. Normal organ and target volume doses in two plans were dosimetrically compared. CTV-tumor volume was covering GTV plus 2 cm proximally and distally, and mesorectum radially. Pelvic lymph node dose was 50.4 Gy with 1.8 Gy/fx and PTV-tumor dose was 56 Gy with 2 Gy/fx in 28 fractions, for both plans. Maximum target volume doses (Dmax), homogeneity index (HI) and conformity number (CN) for target volumes (PTV-Tumor and PTV-Total), maximum bladder dose (Dmax), bladder volumes receiving 40 Gy (V40), 50 Gy (V50), 56 Gy (V56), maximum bowel dose (Dmax), doses to 90 ml (D90), 130 ml (D130) and 230 ml (D230) bowel, mean femoral head (FH) doses (Dmean) and FH volumes receiving 40 Gy (V40), and 50 Gy (V50) were compared between two plans.

RESULTS

Median bladder and bowel volumes were 393 (43-1128) and 1629 (280-4792) cm3, respectively. For both PTV volumes, HI ($p<0.02$) and CN ($p<0.01$) were significantly better in VMAT plans and Dmax was ($p<0.65$) not significantly different between two plans. Bladder and bowel Dmax were not significantly different between VMAT and 3DCRT plans. Bladder V40, V50, V56 volumes and bowel D90, D130 and D230 doses were significantly lower in VMAT plans compared with 3DCRT plans ($p<0.01$). FH Dmean and V40, V50 were significantly lower in VMAT plans compared with 3DCRT plans ($p<0.05$).

CONCLUSION

Except bladder and bowel Dmax, VMAT decreases all normal organ doses compared with 3DCRT in rectal cancer patients treated with neoadjuvant radiation therapy using dose escalated SIB. Clinical studies are needed to evaluate these results' clinical impact on treatment side effects.

CLINICAL RELEVANCE/APPLICATION

VMAT decreases normal organ doses compared with 3DCRT in rectal cancer patients treated with neoadjuvant radiotherapy using dose escalated simultaneous integrated boost, but maximum bladder and bowel doses do not change. Clinical studies needed to evaluate impact of these results on treatment side effects.

SSJ24-04 Fat-Free Muscle Mass Predicts Overall Survival of Patients Undergoing Radioembolization of Colorectal Cancer Liver Metastases

Tuesday, Nov. 27 3:30PM - 3:40PM Room: E261

Participants
Anton Faron, MD, Bonn, Germany (*Presenter*) Nothing to Disclose
Claus C. Pieper, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Martin A. Sprinkart, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Daniel Kuetting, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Daniel K. Thomas, MD, PhD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Carsten Meyer, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Markus Essler, MD, Muenchen, Germany (*Abstract Co-Author*) Nothing to Disclose
Hans H. Schild, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Julian A. Luetkens, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Sarcopenia is associated with poor prognosis in various types of cancer. We therefore aimed to investigate the clinical potential of fat-free muscle mass as a marker for outcome prediction in patients with liver-predominant metastatic colorectal cancer undergoing radioembolization (RE) with 90Yttrium-microspheres.

METHOD AND MATERIALS

Patients with liver-predominant metastatic colorectal cancer who underwent RE between June 2008 and August 2014 at our department were included in this retrospective study. Medical records were reviewed and several clinical parameters were determined. Using standard liver magnetic resonance imaging (MRI) scans, the total erector spinae muscle area and the intramuscular fat tissue area were measured and subtracted to calculate the fat-free muscle area (FFMA). Sarcopenia was defined as FFMA less than 3653 mmSquared and 2866 mmSquared for men and women, respectively. The main outcome was overall survival (OS). Univariate and multivariate Cox-regression analyses were performed comparing various variables with potential impact on OS (e.g. age at RE, bodyweight, ascites prior to RE, cholestasis, clinical scores, tumor burden).

RESULTS

Seventy-seven patients (49 male, mean age 59.9±10.8 years) were investigated. Mean time between MRI and RE was 19±38 days. Mean FFMA was 2878±613 mmSquared in female patients and 3706±779 mmSquared in male patients. Median OS after RE was 200 (range: 25-1650) days. In patients without sarcopenia OS was significantly longer compared to patients with sarcopenia (mean 348±48 vs. 226±36 days, p=0.006). On multivariate Cox-regression analysis, OS was best predicted by FFMA (p<0.001, HR 2.692, 95% CI 1.559-4.648), Model for End-Stage Liver Disease (MELD) (p<0.001, HR 1.165, 95% CI 1.089-1.245), and pattern of tumor manifestation (solitary, oligofocal, multifocal, diffuse) (p<0.001, HR 2.006, 95% CI 1.418-2.840).

CONCLUSION

Fat-free muscle mass might be a new prognostic biomarker for survival prognosis in patients receiving RE for treatment of colorectal liver metastases.

CLINICAL RELEVANCE/APPLICATION

This study offers an easy-to-apply MRI-based measurement of fat-free muscle mass as a marker of sarcopenia which can predict OS in patients receiving RE for treatment of colorectal liver metastases.

SSJ24-05 Stereotactic Body Radiotherapy (SBRT) in Pancreatic Cancer Patients Aged 70 and Older

Tuesday, Nov. 27 3:40PM - 3:50PM Room: E261

Awards
Student Travel Stipend Award

Participants
Rachel Tobillo, Boca Raton, FL (*Presenter*) Nothing to Disclose
Jasmine Martin, MD, Boca Raton, FL (*Abstract Co-Author*) Nothing to Disclose
Michael DeDonno, PhD, Boca Raton, FL (*Abstract Co-Author*) Nothing to Disclose
Gregg H. Goldin, MD, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

rtobillo2015@health.fau.edu

PURPOSE

Over 50% of pancreatic cancer is diagnosed in people over the age of 70, many of whom have limited treatment options due to preexisting comorbidities. This study reports on the outcomes and tolerability of stereotactic body radiation therapy (SBRT) in patients aged 70 and older with pancreatic cancer.

METHOD AND MATERIALS

Twenty-six and 2 patients aged >=70 with pancreatic and ampullary cancer respectively, treated with SBRT +/- chemotherapy and surgery at one institution from 2009 to 2017 were retrospectively reviewed. Patients without up-to-date records or at least 6-months of follow-up were excluded. Patients were analyzed for treatment toxicity, local recurrence, and distant metastases. Kaplan-Meier was used to estimate overall survival, defined as date of diagnosis to date of death or last follow-up.

RESULTS

Median age was 84 years (range 70-94), and median follow-up was 6.9 months. Twenty-five (89%) patients had locally advanced disease and 3 (11%) had metastatic disease. Most common doses delivered were 30, 32.5, 35 and 37.5 Gy (20-45 Gy), most commonly in 5 fractions. Twenty-four (86%) patients were treated at time of initial diagnosis and 4 (14%) were treated for recurrence. Six patients had pre-radiation surgery, either with a Whipple procedure (14%) or an endoscopic resection (7%). Two patients had previously been treated with external beam radiation therapy (EBRT) before SBRT. Nineteen patients (68%) were

treated with some form of chemotherapy. Twenty-one (75%) patients had an acute toxicity grade of 1-2, and 3 patients had an acute toxicity grade of 3, 2 with GI symptoms and 1 with sepsis and fatigue (CTCAE V5.0). Most common acute toxicities were GI symptoms (57%) and fatigue (36%), while most common late morbidities were GI symptoms (68%), fatigue (68%), and nutritional disorders (50%). There were no acute or late grade 4+ toxicities. Fourteen (50%) patients recurred locally, 14 (50%) patients developed distant metastases, and 10 (36%) had both. Median overall survival was 15.0 months.

CONCLUSION

SBRT for pancreatic cancer seems to be a safe and effective method for treatment of elderly patients who decline surgery, have unresectable disease, or comorbidities precluding surgery.

CLINICAL RELEVANCE/APPLICATION

The literature on treatment of elderly patients with pancreatic cancer is sparse. SBRT appears to be safe and effective for those who cannot undergo surgery.

SSJ24-06 Evaluation in Predicting Tumor Sensitivity on Radiotherapy for Esophageal Cancer Using Magnetic Resonance Diffusion Kurtosis Imaging

Tuesday, Nov. 27 3:50PM - 4:00PM Room: E261

Participants
Yanfei Wang, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Gaofeng Shi, MD, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Andu Zhang, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Ruxun Li, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Hui Feng, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Tongxin Xu, Shijiazhuang, China (*Presenter*) Nothing to Disclose
Xiaohui Qi, MD, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

feinier_1989@sina.com

PURPOSE

To evaluate magnetic resonance diffusion kurtosis imaging (MR-DKI) values for predicting the tumor sensitivity on radiotherapy for esophageal cancer.

METHOD AND MATERIALS

There were 40 Eca-109 nude mice models with esophageal cancer xenogrfts before and during radiotherapy (test group=24; control group=16) used in this study. The test group was given 6MV-X line 15Gy single dose during radiation therapy. The control group did not undergo any radiation or other treatments. Sixteen time points included at 1 day before and 1 day after radiotherapy and then very two days during radiotherapy until 29th day. In the time points, mice models in both test and control groups were performed on MRI scan with T1WI, T2WI, and multiple b-value DWI values. Tumor volume, MR-DWI ADC value, MD value and MK value in test group were compared with the control group.

RESULTS

The tumor volume was double at the 5th day in the control group and at the 17th day in the test group after the radiotherapy. At the 7th day after radiotherapy and then, the volume of the transplanted tumor was significantly smaller in the test group (1.729±0.906 mm3) than that in the control group (2.671±0.915 mm3) ($P<0.05$). ADC values in test group rapidly increased at the 3rd day (reached highest point at the 7th day) and then gradually decreased and returned to pre-therapy levels from the 17th day. In the control group, the ADC values gradually decreased from the first day and kept at a low level from the 9th day. The MK values in the test group decreased after radiotherapy (reached lowest point on the 9th day), and then gradually increased to the pre-therapy level from the 17th day. In the control group, the MK values gradually increased (high level since the 17th day). The changes of the MD values were similar to those in ADC values in both groups.

CONCLUSION

MR-DKI values could change prior to tumor morphological features in esophageal cancer during radiotherapy in an animal experimental study, and may have the potential in predicting tumor sensitivity for clinical tumor patients during their radiation or chemotherapy.

CLINICAL RELEVANCE/APPLICATION

(dealing with MR-DKI) 'MR-DKI values could change prior to tumor morphological features in esophageal cancer during radiotherapy in an animal experimental study, and is recommended in predicting tumor sensitivity for clinical tumor patients during their radiation or chemotherapy.'

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

MSRO39

BOOST: Gastrointestinal-eContouring

Tuesday, Nov. 27 4:30PM - 5:30PM Room: S104B

GI OI RO

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Edward Y. Kim, MD, Seattle, WA (*Coordinator*) Nothing to Disclose
Mary U. Feng, MD, San Francisco, CA (*Presenter*) Self: Consultant, Varian, Inc and RefleXion Medical Inc; Spouse (Felix Feng, MD), Advisory Boards Dendreon, Janssen, Bayer, Sanofi, Ferring, EMD Serono, Medivation/Astellas, Blue Earth Diagnostics, Progenics; Spouse, honorarium Clovis
Smith Apisarnthanarax, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Ryan O'Malley, MD, Seattle, WA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

apisarn@uw.edu

Mary.feng@ucsf.edu

LEARNING OBJECTIVES

1) Review radiotherapy contouring and treatment planning techniques for liver tumors. 2) Discuss challenges in radiotherapy target definition across multiple imaging modalities. 3) Highlight important aspects of radiologic anatomy applied to treatment of liver tumors.

RC420

The Role of Molecular and Functional Imaging in Radiation Oncology

Tuesday, Nov. 27 4:30PM - 6:00PM Room: S403B

HN MI NR NM PD RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Nina A. Mayr, MD, Seattle, WA (*Moderator*) Nothing to Disclose

Sub-Events

RC420A The Role of Molecular/Functional Imaging for Radiotherapy in Lymphoma

Participants
Stephanie A. Terezakis, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the significance of molecular/functional imaging in guiding the management of both Hodgkin's and non-Hodgkin's lymphomas. 2) Interpret functional imaging as it relates to treatment response and radiation planning. 3) Determine how to Incorporate PET and CT imaging in delineating radiation treatment volumes utilizing ISRT principles.

RC420B The Role of Molecular/Functional Imaging for Radiotherapy in Pediatric Cancers

Participants
Ralph P. Ermoian, MD, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) List 3 non-central nervous system pediatric diseases in which functional imaging is standard of care for staging. 2) Describe how functional imaging plays a role in assessing response to therapy in two non-central nervous system disease. 3) List two emerging uses for functional imaging in pediatric tumor treatment and response assessment.

RC420C The Role of Molecular/Functional Imaging for Radiotherapy in Head and Neck Cancer

Participants
Minh T. Truong, MBBS, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Role of Molecular/Functional Imaging in the diagnosis and staging of Head and Neck Cancer (HNC). 2) Integrating Molecular/Functional Imaging into Radiotherapy Simulation and Planning. 3) Interpretation of Treatment Response to Chemoradiotherapy. 4) Molecular/Functional Imaging as a Biomarker for Patient Quality of Life and Survival.

RC420D The Role of Molecular/Functional Imaging for Radiotherapy in CNS Tumors

Participants
Anca L. Grosu, MD, Freiburg, Germany (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Amino-acids PET (AA-PET) for tumor detection and differentiation between tumor and treatment-related changes in brain gliomas. 2) Comparison between AA-PET and mpMRI for radiation treatment planning in brain tumors. 3) New concepts for target volume delineation in brain tumors.

RC422

Dual Energy CT for Radiotherapy Applications

Tuesday, Nov. 27 4:30PM - 6:00PM Room: S104A

CT PH RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Kristy K. Brock, PhD, Houston, TX (*Moderator*) License agreement, RaySearch Laboratories AB

Sub-Events

RC422A Clinical Need for Dual Energy CT in Proton Radiotherapy

Participants
Jon J. Kruse, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn about calibration of Hounsfield Units for determination of relative stopping power for proton therapy planning. 2) Discuss potential sources of error in stopping power determination. 3) Describe treatment planning strategies to mitigate range uncertainties in proton therapy planning.

RC422B State of the Art in Dual Energy CT Technology

Participants
Jessica Miller, PhD, Madison, WI (*Presenter*) Research Grant, Siemens AG

LEARNING OBJECTIVES

1) Explain basic dual-energy CT principles. 2) Compare current dual-energy CT techniques and associated limitations.

ABSTRACT

With dual-energy computed tomography (DECT), an additional measurement is obtained, allowing for the reconstruction of supplementary information, such as relative electron density and effective atomic number information. The additional information gained through DECT has potential to aid in several aspects of the radiation therapy process, including improving dose calculation accuracy for proton therapy. This course will discuss the basic principles of DECT and compare different vendor solutions for acquisition of DECT images.

RC422C Technical Challenges in the Integration of Dual Energy CT into Radiotherapy Treatment Planning

Participants
Jon J. Kruse, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Compare range uncertainty to other sources of dosimetric error in proton therapy. 2) Observe clinical examples of range variation in proton therapy.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

MSRO41

BOOST: Pediatrics-Oncology Anatomy and Case-based Multidisciplinary Review (Interactive Session)

Wednesday, Nov. 28 8:30AM - 10:00AM Room: S103CD

OI PD RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Michael S. Gee, MD, PhD, Boston, MA (*Moderator*) Nothing to Disclose
Camilo Jaimes Cobos, MD, Boston, MA (*Presenter*) Nothing to Disclose
Susan L. McGovern, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose
Alison M. Friedmann, MD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

afriedmann@partners.org

msgee@mgh.harvard.edu

camilo.jaimescobos@partners.org

LEARNING OBJECTIVES

1) To apply knowledge of imaging anatomy to pediatric cancer diagnosis and staging. 2) To understand to role of imaging in pediatric cancer diagnosis and treatment.

ABSTRACT

per lead presenter

Active Handout:Camilo Jaimes Cobos

http://abstract.rsna.org/uploads/2018/18002071/RSNA_BOOST_CJ MSRO41.pdf

RC520

Fundamentals of Imaging for the Radiation Oncologist

Wednesday, Nov. 28 8:30AM - 10:00AM Room: S104A

CH GI GU NR RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Stanley L. Liauw, MD, Chicago, IL (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

sliauw@uchicago.edu

Sub-Events

RC520A Fundamentals of Imaging of Liver Cancer in Radiation Oncology

Participants
Michael I. Lock, MD,FRCPC, London, ON (*Presenter*) Speaker, sanofi-aventis Group

LEARNING OBJECTIVES

1) Provide a step-by-step method to distinguish recurrence from normal radiation changes. 2) Appraise new research to better select MRI sequences to localize tumors. 3) Provide an image review of common errors in imaging post radiation.

ABSTRACT

Imaging changes after treatment with radiation can be difficult and misleading. Recent evidence provides insight into better timing of imaging, appropriate MRI sequences (these sequences often differ from sequences used by radiologists) and imaging features that are associated with a higher risk of recurrence.

RC520B Fundamentals of Imaging of Lung Cancer in Radiation Oncology

Participants
Candice A. Johnstone, MD, Milwaukee, WI (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

cjohnstone@mcw.edu

LEARNING OBJECTIVES

1) Define the most appropriate uses for the use of PET-CT in lung cancer. 2) Identify situations when imaging is sufficient for mediastinal staging. 3) Describe new imaging techniques and their application to lung cancer treatment.

RC520C Fundamentals of Imaging of Gynecologic Cancer in Radiation Oncology

Participants
Eric Leung, MD, FRCPC, Toronto, ON (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review imaging modalities for staging, planning and response of gynaecological cancer treatments with radiation therapy. 2) To review imaging techniques in three-dimensional based brachytherapy for locally advanced gynaecological cancers. 3) To review imaging techniques for stereotactic radiation therapy of gynaecological cancers. 4) To review functional imaging techniques for gynaecological cancers and radiation treatment.

RC520D Fundamentals of Imaging of CNS Tumors in Radiation Oncology

Participants
Hui-Kuo G. Shu, MD, PhD, Atlanta, GA (*Presenter*) Speakers Bureau, Varian Medical Systems, Inc; Stockholder, Medtronic plc; Stockholder, Apple Inc; Stockholder, ICON plc; Stockholder, Raytheon

For information about this presentation, contact:

hgshu@emory.edu

LEARNING OBJECTIVES

1) List the imaging modalities most often used by the radiation oncologist in the management of CNS tumors. 2) Explain how specific CNS imaging techniques are utilized to assess the extent of disease prior to initiation of radiation therapy (upfront staging). 3) Describe various imaging evaluations of CNS tumors after radiation therapy for longitudinal response assessment with attention to interpretation of specific results.

ABSTRACT

Radiation therapy (RT) is critical for the overall management of many central nervous system (CNS) tumors. Advances in radiation treatment planning, with techniques such as intensity modulated radiation therapy, volumetric modulated arc therapy, and stereotactic radiosurgery, now allow the delivery of highly conformal doses with very high precision. These techniques rely on high-resolution 3-dimensional anatomic imaging modalities such as computed tomography (CT) and magnetic resonance imaging (MRI) scans to accurately and reliably define CNS targets and avoidance structures. The integration of cross sectional imaging into CNS radiation oncology has directly translated into improvements in the therapeutic window of RT, and the union between radiation oncology and imaging is only expected to grow stronger. In addition to standard imaging such as CT and MRI scans, advanced imaging techniques including diffusion/perfusion/spectroscopic MRIs and positron emission tomography (PET) scans with novel tracers are being used to provide additional insight into CNS tumor biology and behavior beyond anatomy. Together, standard and advanced imaging modalities hold significant potential to improve future RT delivery and response assessment. In this talk, we will discuss the current utilization of standard/advanced imaging for CNS malignancies from a radiation oncology perspective as well as discuss the implications of novel MRI and PET modalities currently under investigation.

RC522

Advanced PET Imaging for Radiotherapy Planning and Response Assessment

Wednesday, Nov. 28 8:30AM - 10:00AM Room: N226

BQ NM PH RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Paul E. Kinahan, PhD, Seattle, WA (*Moderator*) Research Grant, General Electric Company; Co-founder, PET/X LLC

Sub-Events

RC522A State of the Art in PET Imaging

Participants
Paul E. Kinahan, PhD, Seattle, WA (*Presenter*) Research Grant, General Electric Company; Co-founder, PET/X LLC

LEARNING OBJECTIVES

1) Understand the connections between the capabilities of PET imaging and clinical and research uses. 2) Become familiar with recent technical advances in PET imaging and tradeoffs. 3) Gain awareness of initiative in quantitative imaging for clinical trials.

RC522B Technical Challenges in the Integration of PET Imaging into Radiotherapy Treatment Planning

Participants
Stephen R. Bowen, PhD, Seattle, WA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

srbowen@uw.edu

LEARNING OBJECTIVES

1) Understand the differences between diagnostic and treatment planning PET/CT imaging technical requirements. 2) Become familiar with the source and propagation of technical errors in PET/CT-guided radiation therapy. 3) Gain awareness of technical design elements in PET/CT-guided radiation therapy clinical trials.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

MSRO42

BOOST: Lymphoma-Oncology Anatomy and Case-based Multidisciplinary Review (Interactive Session)

Wednesday, Nov. 28 10:30AM - 12:00PM Room: S103CD

CT MR NM OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

Chelsea C. Pinnix, MD, PhD, Houston, TX (*Moderator*) Research Grant, Merck & Co, Inc; Consultant, Global One Inc; Speaker, International Journal of Radiation Oncology, Biology & Physics
Jurgen Rademaker, MD, New York, NY (*Presenter*) Nothing to Disclose
Bradford Hoppe, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose
Alison M. Friedmann, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Case-based review of staging and treatment response in lymphoma (CT, PET, MRI).

SSK19

Science Session with Keynote: Radiation Oncology (Outcomes, Palliation, Sarcoma)

Wednesday, Nov. 28 10:30AM - 12:00PM Room: S504AB

RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Carryn Anderson, MD, Iowa City, IA (*Moderator*) Nothing to Disclose
Edward Y. Kim, MD, Seattle, WA (*Moderator*) Nothing to Disclose

Sub-Events

SSK19-01 The Safety and Efficacy of Interstitial 125I Seeds Implantation Brachytherapy for Metastatic Epidural Spinal Cord Compression

Participants
Chaojie Li, MD, Shanghai, China (*Presenter*) Nothing to Disclose

PURPOSE

To investigate the safety and efficacy of 125I seeds interstitial implantation for metastatic epidural spinal cord compression (MESCC) and the life quality of the patients.

METHOD AND MATERIALS

From April 2009 to May 2015, 28 patients who met the inclusion criteria were retrospectively reviewed. The number of 125I seeds implanted ranged from 7 to 62 with specific activity of 0.5 to 0.8 mCi. The post-plan showed that the tumor matched peripheral dose (MPD) were 80-140 Gy. Follow-up ranged from 1 to 32 months with a median of 18 months. Visual analogue scale (VAS), karnofsky performance scale (KPS) and motor performance were measured before and after treatment.

RESULTS

All patients tolerated seed implantation well. All patients were obviously alleviated pain. VAS scores of patients decreased from 4.89±1.52 before treatment to 1.61±1.20 after treatment, and KPS scores increased from 73.93±12.27 to 86.76±10.90, both differences were statistically significant($P<0.05$). The 1-, 2-, 3- year local control rates were 77%, 34%, and 14%, respectively, with a median of 19 months (7-32 months). The 1-, 2-, 3- year survival rates were 81%, 54%, and 14%, respectively, with a median of 25 months. 7(100%) nonwalking patients regained motor ability. No myelopathies or other neurologic sequelae were encountered.

CONCLUSION

Interstitial 125I seeds implantation brachytherapy was a promising local therapy and an alternative and palliative way to treat MESCC.

CLINICAL RELEVANCE/APPLICATION

To investigate the safety and efficacy of 125I seeds interstitial implantation for metastatic epidural spinal cord compression (MESCC) and the life quality of the patients.

SSK19-02 Cancer-Related Anxiety Following Definitive Treatment of Localized Prostate Cancer: A Population-Based Cohort Study

Wednesday, Nov. 28 10:40AM - 10:50AM Room: S504AB

Awards
Student Travel Stipend Award

Participants
Dominic Moon, MD, Chapel Hill, NC (*Presenter*) Nothing to Disclose
Ram Basak, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Deborah Usinger, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Sarah Walden, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Ronald Chen, MD, Chapel Hill, NC (*Abstract Co-Author*) Consultant, Accuray Incorporated

PURPOSE

Psychological distress following localized prostate cancer treatment is not well-understood. We assessed cancer-specific anxiety post-treatment and factors associated with increase in anxiety level.

METHOD AND MATERIALS

Population-based prospective cohort of newly diagnosed localized prostate cancer patients were enrolled from 1/2011 to 6/2013. A

total of 838 patients who received definitive treatment with radical prostatectomy (RP) or radiotherapy (RT) were analyzed. Patients with recurrence after treatment were excluded. Cancer-related anxiety one year post-treatment was assessed using the validated Memorial Anxiety Scale for Prostate Cancer (MAX-PC) questionnaire, which consists of 3 subscales: recurrence anxiety, PSA anxiety, and prostate cancer anxiety. Multivariable linear regression assessed factors associated with anxiety.

RESULTS

Median age was 64 and 74% were White. In this cohort, 53%, 25%, 11%, and 11% of patients received RP, conventional RT, stereotactic body RT, and brachytherapy, respectively. Multivariable analysis showed that White men had lower recurrence anxiety, PSA anxiety, and prostate cancer anxiety than non-White men (all $p<0.001$), while older men had less PSA anxiety and prostate cancer anxiety compared to younger men ($p=0.002$ and $p=0.001$, respectively). Patients with high risk prostate cancer had increased recurrence anxiety than those with low risk disease ($p=0.04$). Compared to men receiving RP, those receiving brachytherapy and conventional RT had borderline significant increase in recurrence anxiety and PSA anxiety, respectively (both $p=0.05$). Frequency of post-treatment PSA testing and last PSA value were not associated with level of anxiety.

CONCLUSION

White men and older patients overall had less cancer-related anxiety, while high risk patients had increased recurrence anxiety.

CLINICAL RELEVANCE/APPLICATION

Better understanding of factors associated with prostate cancer-related anxiety may aid in counseling patients to improve psychological well-being after definitive treatment.

SSK19-03 Evaluation of Prognostic Factors of Bone Metastasis Treated By Radiotherapy: A Single-Institution Experience

Wednesday, Nov. 28 10:50AM - 11:00AM Room: S504AB

Participants
Nana Shimoyachi, Kanazawa, Japan (*Presenter*) Nothing to Disclose
Tomoyasu Kumano, Ishikawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Shigeyuki Takamatsu, MD, PhD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Aki Kanazawa, Chiba, Japan (*Abstract Co-Author*) Nothing to Disclose
Takayuki Sakurai, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoko Taima, MD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Sae Miyashita, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Toshifumi Gabata, MD, PhD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We investigated the prognostic factors of bone metastases treated by radiotherapy and evaluated the efficacy of prognostic scoring systems in our institution.

METHOD AND MATERIALS

Between April 2011 and December 2016, 288 patients were evaluated (median age, 64 years). The median follow-up period was 11months. The common primary lesion was lung cancer (22%), liver cancer (12%) and prostate cancer (10%). We investigated the overall survival (OS) for all patients using Kaplan-Meier Method and the verification of prognostic prediction using Katagiri score and number of risk factor method (NRF). Katagiri score is scoring system using 6 factors; primary site, metastasis other than bone, poor PS, previous chemotherapy, multiple bone metastasis and abnormality of laboratory data. On the other hand, NRF uses only 3 factors; non-breast cancer, metastases other than bone, and KPS =2). Also, we analyzed factors (gender, age, primary lesion, PS, multiple bone metastases, previous chemotherapy, metastasis other than bone) by a multivariate analysis using the Cox proportional hazards model.

RESULTS

The OS rate for all patients was 42% at 1 year and median survival time was 9 months. In Katagiri score, 190 patients could be scored. The OS rate after 1 year was 79% for low risk (score0-3) and 51% for intermediate risk (score4-6). The OS rates for high risk (score7-10) after 6 months and 1 year were 43% and 19%, respectively. In NRF, all patients could be scored. Patients with a prognostic score of =3, the survival rate was 37% at 6 months, and only 18% at 1 year. Both Katagiri score and NRF, the significant differences are recognized between each all three groups. A multivariate analysis showed the significant prognostic factors for PS, primary lesion, previous chemotherapy, metastasis other than bone. Our results don't contradict the factors of previous studies.

CONCLUSION

We could investigate significant prognostic factors in our institution and show the validity of the prognostic scoring system previously reported.

CLINICAL RELEVANCE/APPLICATION

We could investigate the significant prognostic factors for radiotherapy of bone metastases and show the validity of the prognostic scoring systems (Katagiri score and number of risk factor method).

SSK19-05 Radiation Oncology Keynote Speaker: Sarcoma Keynote

Wednesday, Nov. 28 11:10AM - 11:20AM Room: S504AB

Participants
Matthew B. Spraker, MD, PhD, Saint Louis, MO (*Presenter*) Nothing to Disclose

SSK19-06 Planar and SPECT/CT Imaging in Human Immunodeficiency Virus (HIV) Subjects Diagnosed with Kaposi Sarcoma Using Intravenous 99mTc-tilmanocept

Wednesday, Nov. 28 11:20AM - 11:30AM Room: S504AB

Participants
Frederick O. Cope, PhD, Dublin, OH (*Abstract Co-Author*) Employee, Navidea Biopharmaceuticals, Inc; Stockholder, Navidea Biopharmaceuticals, Inc
Bonnie Abbruzzese, MS, Dublin, OH (*Abstract Co-Author*) Employee, Navidea Biopharmaceuticals, Inc
Allison Kissling, Dublin, OH (*Abstract Co-Author*) Nothing to Disclose
Rachael Hershey, Dublin, OH (*Abstract Co-Author*) Nothing to Disclose
Carley Hartings, Dublin, OH (*Abstract Co-Author*) Nothing to Disclose
David Ralph, PhD, Dublin, OH (*Presenter*) Nothing to Disclose
Ahmad Ismail, Dublin, OH (*Abstract Co-Author*) Nothing to Disclose
Izabela Gierach, Dublin, OH (*Abstract Co-Author*) Nothing to Disclose
Michael Blue, MD, Dublin, OK (*Abstract Co-Author*) Nothing to Disclose
Matthew Haynam, Dublin, OH (*Abstract Co-Author*) Nothing to Disclose
Hannah Bailey, Dublin, OH (*Abstract Co-Author*) Nothing to Disclose
Christopher Gabelmann, Dublin, PR (*Abstract Co-Author*) Nothing to Disclose
Katherine Repp, Dublin, OH (*Abstract Co-Author*) Nothing to Disclose
Vasiliki Stamatopoulou, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Kenneth Gao, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Kieron Leslie, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Spencer C. Behr, MD, Burlingame, CA (*Abstract Co-Author*) Research Grant, General Electric Company Consultant, General Electric Company Consultant, Navidea Biopharmaceuticals, Inc Grant, Navidea Biopharmaceuticals, Inc
Toby Maurer, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

fcope@navidea.com

PURPOSE

To demonstrate Kaposi Sarcoma (KS) lesion imaging by planar and SPECT/CT of cutaneous and subcutaneous KS-associated lesions using 99mTc-tilmanocept (TCT). Such imaging may augment current clinical and biopsies evaluation of KS patients.

METHOD AND MATERIALS

In previous work, we confirmed that Tumor-associated Macrophages (TAMs) and KS cells express the macrophage mannose receptor (CD206), which is the receptor target for TCT. Here we present the first results from a Phase I open-label, dose escalation clinical study of TCT imaging in KS patients. Four subjects with biopsy confirmed cutaneous KS lesions (3 HIV+) were administrated 100 µg of tilmanocept radiolabeled with 5 mCi of 99mTc by intravenous injection (IV) followed by planar and SPECT/CT imaging of areas of interest. Images were acquired at 60 to 75 and 150 to 210 minutes post-injection and were visually cross-examined for uptake in cutaneous and presumably subcutaneous lesions.

RESULTS

IV injection of TCT was well-tolerated. No drug-related adverse events were observed. Uptake on SPECT/CT images was observed in cutaneous lesions of the feet and lower legs as well as suspected subcutaneous lesions of the same regions. All SPECT/CT images were compared to the photographs of KS lesions and other targeted areas of the body taken prior TCT administration. Overall, SPECT/CT imaging revealed highly specific TCT localization in the KS-affected area. Some of the results showed presumptive TCT localization in lymphatic vessels along legs.

CONCLUSION

Results suggest that TCT is a valuable immunodiagnostic agent for imaging of cutaneous and presumably subcutaneous KS lesions. The results shows that this method would improve the accuracy of disease staging in KS patients. TCT imaging may also contribute to monitoring the efficacy of KS therapies.

CLINICAL RELEVANCE/APPLICATION

This is a first attempt of merging TCT imaging data of cutaneous and presumably subcutaneous sites of KS-associated lesions in HIV subjects diagnosed with KS-lesions tissues biopsy results obtained from pathology labs and external medical evaluation of the lesions. Currently, TCT is a first highly specific immunodiagnostic agent, which was proven to support KS evaluation without drug-related adverse events.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Spencer C. Behr, MD - 2017 Honored Educator

SSK19-07 Impact of Lymph Node Dissection and Surgical Margins on Survival Outcomes for Definitive Local Surgery in the Setting of Stage IV Soft Tissue Sarcoma of the Extremity at Presentation: An NCDB Analysis

Wednesday, Nov. 28 11:30AM - 11:40AM Room: S504AB

Awards
Student Travel Stipend Award

Participants
Mustafa Abugideiri, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Jeffrey Switchenko, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Sibo Tian, New Brunswick, NJ (*Abstract Co-Author*) Nothing to Disclose
Nicholas A. Madden, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Robert Press, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Matthew J. Ferris, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

Zachary Buchwald, MD, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Jaymin Jhaveri, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Jim Zhong, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Madhusmita Behera, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
David Monson, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Jolinta Lin, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Jerome C. Landry, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Karen D. Godette, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Pretesh Patel, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

For select patients with stage IV soft tissue sarcoma of the extremity (STSE), definitive surgery to the primary site (SP) is a treatment option as per NCCN and other modalities, such as radiotherapy (R), chemotherapy (C), and metastasectomy (M) can be added to the treatment regimen. We sought to compare the oncologic outcomes of such patients treated with SP in the National Cancer Data Base (NCDB).

METHOD AND MATERIALS

In the NCDB, patients with stage IV STSE who received SP from 2004-2014 with complete treatment records were identified. Survival distributions were estimated using the Kaplan-Meier method and compared using log-rank tests. Covariates were compared using chi-squared tests or ANOVA.

RESULTS

1,291 patients met entry criteria. 5-yr overall survival (OS5) was best for patients treated with metastasectomy (SP+M+/-C+/-R) at 31.4% compared to 20.7% for those treated with other non-surgical adjuvant therapies (SP+C, SP+R, SP+C+R) and 16.2% following SP alone (p<0.0001). Patients with adipocytic tumors had the best OS5 at 29.4% with a median OS of 2.4 years (p=0.0003). On multivariable analysis (MVA), higher Charlson-Deyo score trended with inferior OS (HR 1.20 [95% CI: 0.99-1.45], p=0.07). Patients with well-differentiated tumors had better OS (HR 0.40 [95% CI: 0.17-0.93], p=0.033). 17% of patients had lymph node sampling and this was associated with improved OS (HR 0.75 [95% CI: 0.59-0.94], p=0.014) on MVA. In addition, 27.4% of patients had positive surgical margins, and this was associated with worse OS (HR 1.56 [95% CI: 1.29-1.88], p<0.001). Tumors greater than 10-15cm (HR 1.69 [95% CI: (1.26-2.27) p<0.001) and tumors >15cm (HR 2.04 [95% CI: (1.53-2.73) p<0.001) were predictive for worse OS compared to tumors less than 5cm.

CONCLUSION

In this analysis of a national cancer database, negative surgical margins and lymph node dissection were both associated with prolonged overall survival in patients with stage IV STSE undergoing resection of the primary sarcoma. Metastasectomy was also associated with longer survival is this group. These hypothesis generating data warrant further study.

CLINICAL RELEVANCE/APPLICATION

Surgeons should consider lymph node dissections and re-resections for positive margins in patients with stage IV STSE undergoing resection of the primary sarcoma as both associated with prolonged overall survival. Metastasectomy was also associated with longer survival is this group.

SSK19-08 Radiomic Models of Pathological Markers of Sarcoma, Including Grade and Translocation Status

Wednesday, Nov. 28 11:40AM - 11:50AM Room: S504AB

Awards
Student Travel Stipend Award

Participants
Kevin C. Ball, DO, Milwaukee, WI (*Presenter*) Nothing to Disclose
Matthew B. Spraker, MD, PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Daniel S. Hippe, MS, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company; Research Grant, Canon Medical Systems Corporation; Research Grant, Siemens AG
Landon Wootton, PHD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Robert Ricciotti, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Jose G. Mantilla, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Jan C. Peeken, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Stephanie E. Combs, MD, Heidelberg, Germany (*Abstract Co-Author*) Research Grant, Schering-Plough Corporation Advisory Board, Schering-Plough Corporation Speaker, Schering-Plough Corporation
Edward Y. Kim, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Matthew J. Nyflot, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Soft tissue sarcomas (STS) are traditionally classified by tumor grade, and recently more complex pathologic markers such as translocation status have become of interest. Radiographic correlates may help determine tumor grade and detect targetable mutations, and radiomic features have been correlated to pathologic markers in other tumor types. We examined associations between radiomic features extracted from magnetic resonance images (MRI) of sarcoma with tumor grade and translocation status.

METHOD AND MATERIALS

A retrospective analysis of 199 patients (age>14 years) with histology-confirmed STS was performed. 30 radiomic features (histogram, Haralick, neighborhood difference, and zone size features) were extracted from T1-weighted contrast-enhanced MRI in the tumor volume. FNCLCC grade and translocation status were determined by expert pathologist review. Associations between patients who were grade 1+2 vs 3 and patients with translocation vs no translocation with radiomic features were investigated using univariate logistic regression. P-values were adjusted for multiple comparisons via permutation-based stepdown (A=0.05 for each feature).

RESULTS

101 patients (51%) had grade three STS, and 52 patients (26%) had known translocation. Patients with translocated tumors were younger (42 vs 56 years, p<0.001) with lower grade tumors (p<0.001). Before adjustment, 4 variables were associated with translocation status and 14 radiomic variables were associated with tumor grade. After adjustment, no features were significantly associated with translocation status but 3 features retained significant association with tumor grade (variance, odds ratio [OR]: 0.6, p=0.045; dissimilarity, OR: 0.6, p=0.002; and contrast OR: 0.6, p=0.035).

CONCLUSION

These results suggest translocation-driven STS occur more frequently in younger individuals and are associated with lower grade tumors. Radiomic features examined were not associated with translocation status but were significantly associated with FNCLCC tumor grading of STS. The results suggest radiomic-pathologic models might provide value for patient management in sarcoma in the future.

CLINICAL RELEVANCE/APPLICATION

Radiomic analysis of conventional imaging modalities may elucidate noninvasive sarcoma biomarkers that complement current classification systems.

SSK19-09 A Radiomics Model for Preoperative Metastasis Prediction for Soft-Tissue Sarcomas

Wednesday, Nov. 28 11:50AM - 12:00PM Room: S504AB

Participants
Wenzhe Zhao, Xian, China (*Presenter*) Nothing to Disclose
Xin Huang, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Yiming Wang, Xi an, China (*Abstract Co-Author*) Nothing to Disclose
Wang Yuan, Shaanxi, China (*Abstract Co-Author*) Nothing to Disclose
Jianxin Guo, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Jian Yang, Xian, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To develop and validate a radiomics model based on multimodality images (PET, CT, T1-weighted and T2-weighted MRI) for the early evaluation of the metastasis risk in patients with soft-tissue sarcomas (STSs).

METHOD AND MATERIALS

In this retrospective study, a total of 51 patients with histologically confirmed STSs and clinically followed up for the metastasis were enrolled. Among the 51 patients, 35 were selected randomly as the primary cohort to build the prediction model, while the remaining 16 patients were used to test the prediction power of model. A total of 474 radiomics features were extracted from the single modality image for each patient. Feature selection was performed in 3 steps using Mann-Whitney U test, intra-class Spearman Rank Correlation test and Least absolute shrinkage and selection operator (LASSO) regression. Radiomics signature was developed based on each single modality images or their combinations. Delong test was used to detect the difference levels between the different radiomics signatures. The performance was assessed in discrimination of area under the curve (AUC) and clinical utility using 4-fold cross-validation.

RESULTS

The AUC for radiomics signatures in the primary cohort based on CT, T1-weighted MRI, T2-weighted MRI and PET individually was 0.71, 0.70, 0.80 and 0.73, respectively. In contrast, the AUC for the validation cohort based on CT, T1-weighted MRI, T2-weighted MRI and PET individually was 0.75, 0.82, 0.83 and 0.73, respectively. The combination of the radiomics signatures from CT, T2-weighted MRI and PET images improved AUC, with the optimal performance reached AUC of 0.87 for the training cohort, as well as 0.88 for the validation cohort. Besides, P<0.05 from Delong test showed significant differences between the combination of CT, MRI and PET and others. In addition, decision curve analysis confirmed the clinical usefulness of the multimodality model.

CONCLUSION

A radiomics model, based on CT, T2-weighted MRI and PET images improves the accuracy for the early evaluation of the metastasis risk in patients with STSs.

CLINICAL RELEVANCE/APPLICATION

The non-invasive radiomics model combining CT, T2-weighted MRI and PET images could be used to predict metastasis risk in patients with STSs.

ROS-WEA

Radiation Oncology Wednesday Poster Discussions

Wednesday, Nov. 28 12:15PM - 12:45PM Room: RO Community, Learning Center

RO

AMA PRA Category 1 Credit ™: .50

Participants
Kenneth Wong, MD, Los Angeles, CA (*Moderator*) Nothing to Disclose

Sub-Events

RO221-SD-WEA1 Treatment Patterns of High Dose Rate (HDR) and Low Dose Rate (LDR) Brachytherapy for Prostate Cancer

Station #1

Participants
William R. Kennedy, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Benjamin W. Fischer-Valuck, MD, MS, St. Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Brian Baumann, St. Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Jeff M. Michalski, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Hiram A. Gay, MD, Greenville, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

HDR and LDR brachytherapy (BT) are both NCCN recommended treatment modalities for localized prostate cancer. The choice of HDR versus LDR is dependent on patient, physician, and hospital preference. The purpose of this registry-based analysis was to investigate patient and clinical characteristics associated with the receipt of HDR or LDR brachytherapy for localized prostate cancer.

METHOD AND MATERIALS

We queried the National Cancer Database (NCDB) for patients with localized low or intermediate risk prostate cancer (<=cT2c, Gleason score <=7, and/or PSA <20) treated with either HDR or LDR brachytherapy. Descriptive statistics were used to analyze patterns of HDR compared to LDR use. Patient demographics and disease characteristics were correlated with HDR vs LDR using multivariable logistic regression.

RESULTS

A total of 50,326 patients from 2004-2014 were included (LDR: 37,863 (75.2%) vs. HDR: 12,463 (24.8%)). Median follow-up was 70.3 months and similar in both groups. In 2004, HDR accounted for 27.0% of brachytherapy cases compared to 19.2% in 2014. Using multivariable analysis, variables associated with increased likelihood of receiving HDR included: increasing year of age (OR: 1.01, 95% CI, 1.01-1.01;P=0.007), cT2c disease (OR: 1.25, 1.11-1.41;P<0.0001), treatment at an academic/research center (OR: 2.45, 2.24-2.65; P<0.0001), non-white race (OR: 1.34, 1.27-1.42; P<0.0001), and income >$63,000 (OR: 1.73, 1.59-1.88; P<0.0001). LDR was more common in the years of 2010-2014 (OR: 0.59, 0.54-0.65; P<0.0001), for patients with Charlson-Deyo comorbidity >0 (OR: 0.89, 0.84-0.95; P=0.001), and for patients receiving hormone therapy (OR: 0.88, 0.83-0.93; P<0.0001). No difference in PSA value or Gleason Score and receipt of HDR vs. LDR was observed. Mean overall survival was 127.0 months for HDR and 125.4 months for LDR.

CONCLUSION

Despite similar overall survival outcomes, the use of HDR brachytherapy declined over the study period examined. In this cohort, HDR was more common in patients with cT2c disease and hormone therapy was more common in the LDR group.

CLINICAL RELEVANCE/APPLICATION

Our work revealed a decline in HDR brachytherapy for localized prostate cancer and identified important factors influencing use of LDR vs. HDR in the largest comparison of BT modalities to date.

RO222-SD-WEA2 Effect of the Change in a Reactor Power on the Response of Murine Solid Tumors in Vivo, Referring to that in Intratumor Quiescent Cells and Its Clinical Significance in Boron Neutron Capture Therapy (BNCT)

Station #2

Participants
Shinichiro Masunaga, MD, Osaka, Japan (*Presenter*) Nothing to Disclose
Yoshinori Sakurai, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroki Tanaka, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Takushi Takata, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Keizo Tano, PhD, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Yu Sanada, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Minoru Suzuki, MD, PhD, Sennan, Japan (*Abstract Co-Author*) Nothing to Disclose
Akira Maruhashi, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Koji Ono, MD, PhD, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To examine the effect of the change in a reactor power on the response of solid tumors in vivo, with reference to that in quiescent (Q) tumor cells, and discuss its clinical significance in boron neutron capture therapy (BNCT).

METHOD AND MATERIALS

SCC VII tumor-bearing mice received 5-bromo-2-deoxyuridine (BrdU) continuously to label all intratumor proliferating (P) cells, and were treated with a 10B-carrier, boronophenylalanine-10B (BPA) or sodium mercaptododecaborate-10B (BSH). Right after reactor neutron beam irradiation at a power of 1 or 5 MW with a similar beam spectrum each other at Kyoto University Research Reactor, cells from some tumors were isolated and incubated with a cytokinesis blocker. The responses of BrdU-unlabeled Q and total (= P+Q) tumor cells were assessed based on the frequencies of micronucleation using immunofluorescence staining for BrdU.

RESULTS

Following reactor neutron irradiation with or without 10B-carrier administration, the reduction in sensitivity caused by a decrease in radiation dose rate due to a decrease in a reactor power was clearly observed in both tumor cells, especially with BPA or in Q tumor cells. The sensitivity difference between total and Q tumor cells was widened in combination with 10B-carrier administration, especially with BPA, and through decreasing a reactor power. The calculated values of compound biological effectiveness (CBE) factors for each 10B-carrier showed a tendency that the values for BPA, in Q cells, and at a power of 5 MW were larger than those for BSH, in total cells, and at a power of 1 MW, respectively.

CONCLUSION

The observed dose rate effect supported a better advantage of 5 MW as a reactor power than 1 MW. Moreover, 5 MW showed a better advantage than 1 MW in terms of reducing the sensitivity difference between total and Q cells. The rise in a reactor power enlarged the values of CBE factor for both 10B-carriers. In clinics, it takes 5 times longer time at a power of 1 MW than 5 MW to perform one session of BNCT. Patients cannot move their body at the optimum treatment position during BNCT. Thus, 5 MW is more useful and convenient than 1 MW as a reactor power in clinical BNCT.

CLINICAL RELEVANCE/APPLICATION

The higher a reactor power is, the better clinical results are thought to be able to be expected in BNCT.

ROS-WEB

Radiation Oncology Wednesday Poster Discussions

Wednesday, Nov. 28 12:45PM - 1:15PM Room: RO Community, Learning Center

RO

AMA PRA Category 1 Credit ™: .50

Participants
Kenneth Wong, MD, Los Angeles, CA (*Moderator*) Nothing to Disclose

Sub-Events

RO224-SD-WEB1 Assessment of Extended Field Bone Marrow Sparing Radiotherapy for Primary Chemoradiotherapy in Stage IVB Cervical Cancer Patients with Para-aortic Lymphadenopathy: Volumetric Modulated Arc Therapy Versus Helical Tomotherapy

Station #1

Participants
Jenny Ling-Yu Chen, MD,PhD, Taipei, Taiwan (*Presenter*) Nothing to Disclose
MiaoCi Wang, Taipei, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Cheyu Hsu, MD, Taipei, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Yu-Sen Huang, MD, Taipei, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Keng-Hsueh Lan, MD,PhD, Taipei, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Sung-Hsin Kuo, MD, PhD, Taipei, Taiwan (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

lychen@ntu.edu.tw

PURPOSE

This study aimed to compare the dosimetric quality and effectiveness of volumetric-modulated arc therapy (VMAT) vs. helical tomotherapy (HT) when administering extended-field bone marrow sparing (BMS) chemoradiotherapy to stage IVB cervical cancer patients with para-aortic lymphadenopathy.

METHOD AND MATERIALS

Twelve stage IVB cervical cancer patients with para-aortic lymphadenopathy who received VMAT extended-field BMS radiotherapy in 2017 were investigated. HT dose-volume histogram parameters were generated and compared to those of VMAT. The pelvis and the para-aortic region received 45 Gy (25 fractions) with a simultaneous integrated boost of 55 Gy (25 fractions) to pelvic and para-aortic lymphadenopathy, followed by a parametrial boost of 9 Gy (5 fractions), then by intracavitary high-dose-rate brachytherapy.

RESULTS

Both the HT-based and VMAT techniques achieved adequate and similar planning target volume coverage with good dose homogeneity and conformity. High-dose rectal doses were significantly reduced with VMAT. Both techniques similarly and sufficiently spared the organs-at-risk. The HT treatment plan had significantly higher monitoring units and longer estimated treatment times. All patients completed their planned extended-field BMS radiotherapy via VMAT, and 83.3% completed ?>=5 cycles of concurrent cisplatin. The median low dose rate-equivalent to point A was 8667 cGy. The incidence of grade >=3 neutropenia was 8.3%. At a median follow-up time of 13.5 months, the 1-year cumulative incidence of locoregional failure, distant metastasis, and grade >=3 late toxicity for all patients were 0%, 20.5%, and 12.5%, respectively.

CONCLUSION

Both HT-based and VMAT techniques are feasible for achieving EF BMS. The PTV coverage was not compromised owing to the addition of the BMS planning constraint in with either technique. Moreover, the dose remained homogeneous with the inclusion of a simultaneous integral boost for lymphadenopathy, and the OARs were protected. Notably, a significant reduction in rectal high-dose volumes was achieved using VMAT.

CLINICAL RELEVANCE/APPLICATION

Both HT- and VMAT-based extended-field, bone marrow-sparing techniques achieved adequate PTV coverage and produced sufficient and similar protection of the organs-at-risk; Notably, high-dose rectal doses were significantly reduced with VMAT.

RO225-SD-WEB2 4D Perfusion CT of Prostate Cancer for Radiotherapy Planning: A Proof of Concept Study

Station #2

Participants
Lucian Beer, MD,PhD, Vienna, Austria (*Presenter*) Nothing to Disclose
Stephan H. Polanec, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Pascal A. Baltzer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Dietmar Georg, PhD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Anja Dutschke, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Georg Schatzl, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

Helmut R. Ringl, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Paul Apfaltrer, MD, Vienna, Austria (*Abstract Co-Author*) Institutional research collaboration, Siemens AG
Thomas H. Helbich, MD, Vienna, Austria (*Abstract Co-Author*) Research Grant, Medicor, Inc Research Grant, Siemens AG Research Grant, C. R. Bard, Inc

PURPOSE

External beam radiotherapy is the therapy of choice in the treatment of high-risk disease prostate cancer (PCa) The aim of this study was to evaluate dynamic contrast enhanced computed tomography (DCE-CT) for the identification and delineation of target volumes in patients with prostate cancer.

METHOD AND MATERIALS

With IRB approval and in HIPAA compliance 31 consecutive patients (mean age 67 years; range, 45-81 years) underwent DCE-CT on a 3rd generation DSCT system as well as multiparametric magnet resonance imaging study (mpMRI) including standard T2, DWI and DCE-MRI sequences followed by transrectal MRI guided lesion biopsy. DCE-CT perfusion parameters (CTP) included: blood volume, BV; blood flow; BF, flow extraction product, FEP; mean transit time, MTT. Perfusion Parameters were compared between regular and malignant tissue. MRI perfusion parameters included: transfer constant Ktrans, fractional volume of the extravascular-extracellular space, Ve and contrast agent backflux rate constant kep. CTP and MRI perfusion parameters were compared using spearman correlation coefficient.

RESULTS

21 (70%) of patients were PCa positive with a median Gleason score of 7 (range 6 -9). DCE-CT perfusion parameters enabled identification of histopathological correlated PCa tissue with significant differences of PCa to normal prostate tissue in all CTP values (MIP 106.3 vs. 91.8 HU; BFD 42.9 vs. 28.5 mL/100L/min; BVD 3.2 vs. 1.7 mL/100mL; MTTD 5.1 vs. 4.6 seconds; FEP 19.0 vs. 13.3 mL/100mL/min; $p<0.05$). Also, DCE-CT BFD was different between benign and malignant lesions (26.1 vs. 42.9 mL/100 mL/min; $p=0.01$). CTP values significantly correlated with MRI-perfusion parameters (BV-Ktrans: $r=0.49$; $p=0.046$).

CONCLUSION

Our preliminary results suggest that in patients with prostate cancer assigned for RT treatment DCE-Prostate CT allows accurate identification and delineation of target volumes.

CLINICAL RELEVANCE/APPLICATION

DCE-CT of the prostate may be used for identification and delineation of target volumes in patients with prostate cancer and might further serve as a tool for a DCE-CT-based intraprostatic focal dose escalation approach.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

MSRO43

BOOST: Pediatric CNS Tumors and Diagnostic Dilemmas after Radiation Therapy (Interactive Session)

Wednesday, Nov. 28 1:30PM - 2:30PM Room: S103CD

NR PD RO

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Edward Y. Kim, MD, Seattle, WA (*Moderator*) Nothing to Disclose
Kenneth Wong, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Benita Tamrazi, MD, South Pasadena, CA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

kewong@chla.usc.edu

LEARNING OBJECTIVES

1) Discuss the basic epidemiology, diagnostic workup, and evaluation of a child with a suspected CNS tumor. 2) Select and apply the different therapeutic alternatives in radiation therapy delivery for pediatric CNS cancers. 3) Identify advanced imaging modalities to resolve diagnostic dilemmas after radiation therapy for pediatric CNS tumors.

PS40

Wednesday Plenary Session

Wednesday, Nov. 28 1:30PM - 2:45PM Room: E450A

RO

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credit: .75

Participants
Vijay M. Rao, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Sub-Events

PS40A **Announcement of Education Exhibit Awards**

PS40B **Announcement of Quality Improvement Report Awards**

PS40C **Dedication of the Annual Oration in Radiation Oncology to the Memory of Seymour H. Levitt, MD (1928-2017)**

PS40D **Annual Oration in Radiation Oncology: Radiotherapy to Convert the Tumor Into an In Situ Vaccine**

Participants
Silvia C. Formenti, MD, New York, NY (*Presenter*) Research Grant, Bristol-Myers Squibb Company; Research Grant, Varian Medical Systems, Inc; Research Grant, Johnson & Johnson; Research Grant, Regeneron Pharmaceuticals, Inc; Research Grant, Eisai Co, Ltd; Research Grant, Merck & Co, Inc; Speaker, Bristol-Myers Squibb Company; Speaker, Varian Medical Systems, Inc; Speaker, Johnson & Johnson; Speaker, Regeneron Pharmaceuticals, Inc; Speaker, Eisai Co, Ltd; Speaker, Merck & Co, Inc; Speaker, Elekta AB; Speaker, GlaxoSmithKline plc; Speaker, AstraZeneca PLC; Speaker, Dynavax Technologies Corporation
Edward Y. Kim, MD, Seattle, WA (*Introduction*) Nothing to Disclose

Abstract

Optimal delineation of the target and real-time visualization of organ movement have converged radiology and radiation oncology to achieve a more and more precise and effective delivery of cytotoxic ionizing radiation. This partnership between our two disciplines continues in the era of cancer immunotherapy. Radiotherapy has revealed an ideal adjuvant to cancer immunotherapy, because of its ability to convert the irradiated tumor into an individualized, in situ vaccine. When successful at immunizing, radiotherapy evokes T cell memory, and induces effects outside the treated field, defined as abscopal effects (responses at a distant, synchronous, un-irradiated established tumor or metastasis). In the setting of clinical cancer, however, abscopal effects are extremely rare, because of immune-suppressive characteristic of established solid tumors (Curr Probl Cancer 40;25-37, 2016). Thus, strategies to exploit the pro-immunogenic effects of radiotherapy require combination with immunotherapy: experiments in several syngeneic mouse models that mimic the setting of advanced cancer have demonstrated promise of combining radiation with immune checkpoint blockade (Clin Cancer Res. 2005;11:728-734). Radiation can compensate tumors with a low mutational load, by inducing de novo T cell priming to multiple tumor antigens and therefore, achieve responses in the absence of pre-existing neoantigens with anedoctal clinical examples confirming the preclinical data (Trends Cancer 2016:2,6:286-294). Currently, multiple clinical trials are exploring optimal regimes of radiotherapy and immunotherapy, with some initial success. The issue of dose and fractionation seems to be particularly relevant to abscopal responses. A mechanism underlying the dose dependence of abscopal response was recently elucidated (Nature Communications 2017; Jun 9;8:15618). In mice bearing bilateral TSA murine breast carcinoma when combined with ICB a single dose of 20 or 30Gy achieved comparable in field control to that of a regimen of 8GyX3 fractions, but only the fractionated regimen induced abscopal responses. Radiation-generated double strands (ds) DNA fragments reach the cytoplasm of irradiated cells where they are "sensed" by the cGAS/STING pathway (cGAS=cyclic GMP-AMP synthase and its adaptor protein STING= stimulator of interferon genes, aka transmembrane protein 173 - TMEM173). cGAS binds cytosolic dsDNA to initiate interferon (IFN-I) responses upon STING stimulation, resulting in dendritic cell recruitment and cross-priming of effector T-cells, the key steps to convert the tumor into an in situ vaccine. When tested in multiple carcinoma murine and human carcinoma cells as the radiation dose per fraction increases, cytosolic dsDNA was found to accumulate to a threshold above which induction of three prime repair exonuclease 1 (Trex1) occurred, an enzyme that degrades cytoplasmic DNA. Single doses in excess of 10-12Gy induced Trex1 to rapidly degrade cytosolic dsDNA, the substrate for cGAS/STING. As a result, signaling to induce IFN was abrogated, impairing RT-induced abscopal effects. Consideration to these findings suggest that a hypo-fractionated regimen, ideally with 3-5 doses of less than 10-12 Gy each, should be used when radiotherapy is combined with immunotherapy. Finally, non-invasive strategies to follow the kinetics of tumor immune-infiltration are warranted. Image co-registration and total body monitoring of immune response are investigational priorities that once again converge radiology and radiation oncology.

ï¿½G`ï¿½ï¿½mï¿½

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

MSRO44

BOOST: Advanced Techniques in Image-guided Therapy (Interactive Session)

Wednesday, Nov. 28 3:00PM - 4:15PM Room: S103CD

CT MR NM RO

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants
Theodore S. Hong, MD, Boston, MA (*Presenter*) Nothing to Disclose
Susanna I. Lee, MD,PhD, Boston, MA (*Presenter*) Editor, Wolters Kluwer nv
Homer A. Macapinlac, MD, Houston, TX (*Presenter*) Nothing to Disclose
Peter Balter, PhD, Houston, TX (*Presenter*) Research Grant, Varian Medical Systems, Inc; Research Grant, RaySearch Laboratories AB

For information about this presentation, contact:

slee0@mgh.harvard.edu

LEARNING OBJECTIVES

1) Explain and apply modern CT and MR imaging technologies and PET tracers for treatment planning of solid malignancies in the chest, abdomen and pelvis. 2) Explain and apply the modern techniques in radiotherapy safely and effectively in the chest, abdomen and pelvis.

ABSTRACT

The last decade has seen emergence of important advances in locoregional cancer therapy. Use of functional imaging and advanced radiatiotherapy often integrated with targeted chemotherapy have improved patient outcomes. This course will present the underlying principles in diffusion MRI, novel MR contrast agents, PET-MR and dual energy CT. PET tracers to be discussed are F-18 FDG, widely used for most solid tumors; C-11 choline/F-18 Fluciclovine for prostate cancer and Ga-68-DOTATATE for neuroendocrine tumors. Advanced radiotherapy techniques such as Image Guided Radiotherapy (IGRT), Intensity Modulated Radiation Therapy (IMRT), and Stereotactic Body Radiation Therapy (SBRT) using image guidance with X-ray, CT, MRI and PET will be described.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/ Susanna I. Lee, MD,PhD - 2013 Honored Educator

SSM22

Radiation Oncology (Genitourinary)

Wednesday, Nov. 28 3:00PM - 4:00PM Room: E261

AI GU MR OI RO

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Martin Colman, MD, Houston, TX (*Moderator*) Stockholder, Steward Health Care
Edward Y. Kim, MD, Seattle, WA (*Moderator*) Nothing to Disclose

Sub-Events

SSM22-01 Deep Decision Forests of Radiomic Features for Automatic Contouring of Pelvic Anatomy for Prostate Radiotherapy

Wednesday, Nov. 28 3:00PM - 3:10PM Room: E261

Participants
Meghan W. Macomber, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Mark H. Phillips, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Ivan Tarapov, MSc, Redmond, WA (*Abstract Co-Author*) Nothing to Disclose
Rajesh Jena, MD, FRCR, Cambridge, United Kingdom (*Abstract Co-Author*) Royalties, Microsoft Corporation;
Antonio Criminisi, PhD, Cambridge, United Kingdom (*Abstract Co-Author*) Employee, Microsoft Corporation
Matthew J. Nyflot, PhD, Seattle, WA (*Presenter*) Nothing to Disclose

PURPOSE

Machine learning for image segmentation is a potentially innovative approach to improve efficiency and promote standardization for radiotherapy treatment planning. We evaluated a new model that uses deep decision forests of image features to contour pelvic anatomy on treatment planning CTs.

METHOD AND MATERIALS

We anonymized 193 prostate treatment planning CTs (acquired 2012-2016 at 1 UK and 2 US sites, GE and Toshiba scanners, 512x512 pixels inplane, 1.25 or 2.5 mm between slices). A deep decision forest (DF) was trained to contour prostate, bladder, rectum, femurs, and seminal vesicles on 94 images from Site 1. Testing was done on 99 separate scans (n=35, 34, and 25 from Site 1, 2, and 3). Similarity between DF contours and clinical (ground truth) contours was measured with Dice score (DSC) in the validation datasets. DF performance was compared to four commercial tools on a random subset of images (n=20). Additionally, interobserver variability (IOV) between three physicians' contours and ground truth was evaluated on 10 random images and compared to DF performance with Student's t-test.

RESULTS

Across all sites, DF agreement with ground truth was: bladder, DSC 0.94-0.97 [interquartile range (IQR) 0.92-0.98], prostate, DSC 0.75-0.76 [IQR 0.67-0.82], rectum: DSC 0.71-0.82 [IQR 0.63-0.87], femurs: DSC 0.96-0.97 [IQR 0.94-0.97], seminal vesicles: DSC 0.49-0.70 [IQR, 0.31-0.79]. The results were similar across the three sites (e.g. median prostate DSC for each site was 0.76, 0.76, 0.75). In the commercial model comparison, DF had highest DSC for all organs, followed by the two model-based systems, with atlas-based systems having worst performance. For IOV data, variability between DF and ground truth was smaller than variability between raters for prostate (median DSC 0.87 vs 0.77, p=0.006) and femurs (median DSC 0.973 vs 0.968, p=0.002), and not significantly different for other contours (p>0.3).

CONCLUSION

Deep decision forests are effective at contouring pelvic anatomy for radiotherapy planning, with good performance relative to commercial programs, and agreement with ground truth was as similar as can be expected between human experts.

CLINICAL RELEVANCE/APPLICATION

Machine learning methods for automated treatment planning would be useful to improve clinical efficiency and increase standardization in radiation oncology.

SSM22-02 Nationwide Prostate Cancer Outcome Prediction Study of Permanent Iodine-125 Seed Implantation: Outcome Prediction Using Machine Learning Techniques with Cohort 1

Wednesday, Nov. 28 3:10PM - 3:20PM Room: E261

Participants
Taiki Magome, Tokyo, Japan (*Presenter*) Nothing to Disclose
Katsumasa Nakamura, MD, PhD, Hamamatsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Takashi Kikuchi, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinsuke Kojima, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuto Ito, Maebashi, Japan (*Abstract Co-Author*) Nothing to Disclose

Atsunori Yorozu, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Shiro Saito, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Masanori Fukushima, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The nationwide Japanese Prostate Cancer Outcome Study of Permanent Iodine-125 Seed Implantation (J-POPS) is a big novel data with the fundamental aim of collecting clinical data as a prospective cohort study. The purpose of this study is to predict prostate cancer outcome after brachytherapy based on machine learning techniques using J-POPS big data.

METHOD AND MATERIALS

Among 72 hospitals performing brachytherapy in Japan, 46 (64 %) hospitals provided 2,339 cases of the J-POPS cohort 1. Patient/family background, TNM classification, serum PSA level, Gleason score, brachytherapy and external radiotherapy parameters, adverse event and outcome information, etc. were included in the survey items. Two types of dataset were used for the prediction; i.e., the large dataset including the majority of survey items, and limited dataset including only the survey items which are considered as relevant items with the outcome by radiation oncologists. In this study, four machine learning algorithms, i.e., logistic regression (LR), support vector machine (SVM), random forest (RF), and deep neural network (DNN) were tested. Outcome information including biochemical failure and rectal/urinary toxicity were predicted by the machine learning techniques. The prediction accuracy, defined as (true positive + true negative cases) / all cases, was evaluated by 10-fold cross-validation test.

RESULTS

The prediction accuracy with the large dataset was higher than that with the limited dataset in each machine learning algorithm. Although 5.2 percent of cases showed the biochemical failure, the highest accuracy of biochemical failure prediction with a large dataset and limited dataset was 0.938 and 0.892, respectively, for test data. The prediction model using RF had the highest accuracy.

CONCLUSION

Our results showed a potential to predict the outcome of prostate cancer patients with the big nationwide data including many survey items.

CLINICAL RELEVANCE/APPLICATION

Prostate cancer outcome after brachytherapy could be accurately predicted with big nationwide data.

SSM22-03 Dose to the Bladder Neck in MRI-guided High Dose-Rate Prostate Brachytherapy

Wednesday, Nov. 28 3:20PM - 3:30PM Room: E261

Participants
Noelia Sanmamed, MD, Toronto, ON (*Presenter*) Nothing to Disclose
Peter Chung, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Sangeet Ghai, MD, Toronto, ON (*Abstract Co-Author*) Grant, InSightec Ltd Grant, Exact Imaging Inc
Alejandro Berlin, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Jette Borg, PhD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Bernadeth Lao, BSC, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Robert Weersink, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Anna Simeonov, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Alexandra Rink, PhD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Cynthia Menard, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Joelle Helou, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We aim to assess the impact of the dose to the bladder neck (BN) on physician and patient-reported GU toxicity after MRI-guided high dose-rate brachytherapy (HDR-BT) boost.

METHOD AND MATERIALS

Sixty-three patients were treated with a single 15-Gy MRI-guided HDR-BT implant followed by external beam radiotherapy. MRI-based treatment planning was used. The clinical target volume (CTV) was defined as the prostate and planning target volume was CTV + 2mm craniocaudal margin. BN was delineated in retrospect on T2-weighted images by a radiation oncologist (RO) and reviewed by an independent RO and a radiologist. Dosimetric parameters, acute (<=3 months) toxicity using CTCAE v.4 and health-related quality of life (HRQoL)using the expanded prostate index composite (EPIC) were collected prospectively. A minimally important difference (MID) was defined as a deterioration of HRQoL scores at 3 months compared to baseline >= 0.5 standard deviation of baseline score. Linear and logistic regression models were used to assess the impact of BN dose on GU toxicity and HRQoL. A p-value <=0.05 was considered statistically significant.

RESULTS

The median BN volume was 0.6 cc [interquartile range (IQR): 0.4-0.7]. Median maximum dose to the BN (BNDmax) and urethra (UDmax) was 24.9 Gy (IQR 18.8- 26.4) and 17 Gy (IQR 16.7- 17.7) respectively. Median dose to 2cc of the urethra was 52 Gy (IQR: 36-62). BNDmax was significantly associated with UDmax (p=0.027) and 7.7% of the total amount of variation in BNDmax was explained by the UDmax (R2=0.059, p=0.028). Grade 2+ GU toxicity was observed in 31% of patients. Among those, 4 patients had an acute urinary retention. No grade 4+ toxicity was reported. Furthermore 46% of patients reported a MID in EPIC urinary domain score at 3 months. None of the dosimetric parameters including BNDmax was associated with acute grade 2+ urinary toxicity or MID. However, 3 out of 4 patients with acute urinary retention had a BND max in the highest quartile; 26.4, 28.3 and 52.7 Gy (>175% of prescription dose).

CONCLUSION

MRI-based planning offers a unique opportunity to delineate and assess the dose to the BN. Although the predictive value of this parameter is yet to be determined in a larger population, it is worthwhile including BN contours and constraints into HDR-BT

treatment planning if an MRI-planning is available.

CLINICAL RELEVANCE/APPLICATION

Uncertainties exist regarding bladder neck definition.

SSM22-04 Machine Leaning Based Prediction of Prostate Cancer Recurrence After Radiotherapy with Radiosensitivity Related Proteins

Wednesday, Nov. 28 3:30PM - 3:40PM Room: E261

Participants
Takuya Mizutani, Tokyo, Japan (*Presenter*) Nothing to Disclose
Taiki Magome, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Masanori Someya, MD,PhD, Hokkaido, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomokazu Hasegawa, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Koichi Sakata, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

mizutaku17@gmail.com

PURPOSE

There are several reports that the expression of proteins in tumors related to radiosensitivity could be used as biomarkers for the outcome prediction after radiotherapy. The purpose of this study was to predict local relapse of prostate cancer after radiotherapy using a machine learning methodology with the combination of conventional factors and the protein information related to radiosensitivity.

METHOD AND MATERIALS

A total of 100 patients with localized adenocarcinoma of the prostate who were treated from 2001 to 2010 were included in this study. Support vector machine (SVM) was used as a machine learning methodology to predict local relapse of prostate cancer. Candidate input features for the prediction included 16 clinical features (age, Gleason score, PSA level, etc.), 16 radiation dose features (mean dose, dose per fraction, etc.) and 3 protein information related to radiosensitivity (Ku70, Ku86, XRCC4). Effective features for prediction were determined by a sequential forward selection using Akaike's information criterion. The prediction performance of the models with or without protein information were compared by a leave-one-out cross-validation test. Accuracy, sensitivity, specificity and Matthew's correlation coefficient (MCC) were used as prediction performance metrics.

RESULTS

The prediction performance was improved by considering the radiosensitivity related protein information, e.g., accuracy of the models with and without the protein information was 0.78 and 0.69, respectively. Ku70 was the most selected feature in the proteins related to radiosensitivity.

CONCLUSION

Our result showed the potential to predict local relapse of prostate cancer with the combination of conventional factors and the protein information related to radiosensitivity. Accurate outcome prediction after radiotherapy could be useful for personalized optimal selection of treatment modalities of cancer.

CLINICAL RELEVANCE/APPLICATION

Accuracy of the machine learning model for outcome prediction after radiotherapy could be improved with the radiosensitivity related protein information.

SSM22-05 Prostate Cancer: Assessment of Toxicity of Focal Dose Escalation of Radiotherapy Guided by Multiparametric Magnetic Resonance Imaging

Wednesday, Nov. 28 3:40PM - 3:50PM Room: E261

Participants
Michael W. Schmuecking, Hamburg, Germany (*Presenter*) Nothing to Disclose
Volker Brandes, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Arne Blechschmidt, MS, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Sarah Lomp, MS, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Imke Luetjens, MS, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Matthias Roethke, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

schmuecking@strahlentherapie-veritaskai.com

PURPOSE

To evaluate acute and late toxicity after moderately hypofractionated radiotherapy of prostate cancer with focal dose escalation guided by multiparametric magnetic resonance imaging (mpMRI) using intensity-modulated treatment planning and image-guided treatment (IGRT) delivery.

METHOD AND MATERIALS

58 patients (age 55-82y, cT2/cT3, initial PSA 3.3-16.4ng/ml, Gleason Score >3+4) were included into the study. Before implantation of three gold markers, each patient underwent mpMRI (T2-TSE, DCE, DWI) that detected a suspicious focal lesion (PIRADS 4+5) followed by image fusion with the radiation treatment planning CT. In total, a dose of 79.2Gy in 33 fractions (single dose 2.4Gy) were prescribed to PIRADS 4 and 5 intraprostatic lesions with a margin of 3mm (gross target volume + 3mm = planning target volume) delivered with a simultaneous integrated boost (SIB) by static field intensity-modulated radiotherapy (IMRT) or volumetric modulated arc therapy (VMAT). Further dose levels were 76.23Gy and 60.06Gy prescribed to the prostate and the

seminal vesicles, respectively. Patients with high risk prostate cancer received 46Gy to the pelvic lymphatics, lymph node metastases 60Gy in 25 fractions with SIB. Daily IGRT by cone-beam computed tomography (CBCT) in addition to gold markers. Acute and late gastrointestinal (GI) and genitourinary (GU) toxicity was evaluated using CTCAE v4.03.

RESULTS

Treatment was completed according to the treatment plan in all included patients. Acute GI and GU toxicity grade >=2 was observed in 13.8% and 39.6% of the patients, respectively, with 6.8% suffering from GU toxicity grade 3. Six weeks after treatment, the incidence of acute toxicity grade >=2 had decreased to 15.5%. With a median follow-up of 28 months, late GI and GU toxicity grade >=2 was seen in 1.7% and 8.6% of the patients, respectively. Three patients developed late toxicity grade 3 (GI n=2; GU n=1).

CONCLUSION

Moderately hypofractionated high-dose radiotherapy with further dose-escalation to mpMRI PIRADS 4 and 5 lesions resulted in acceptable rates of acute and late toxicity according to the current literature. Conformal IMRT / VMAT planning and accurate daily IGRT treatment delivery using goldmarker and CBCT may have contributed to these results.

CLINICAL RELEVANCE/APPLICATION

The use of mpMRI for focal dose escalation in patients with prostate cancer may enhance post-radiotherapeutic local control.

SSM22-06 Weekly Magnetic Resonance Imaging Using a Linear Accelerator Equipped with a 1.5 Tesla MRI (MR-Linac) Reveals Intra-Treatment Signal Variance in Regional Organs at Risk (OAR), An Exploratory Analysis

Wednesday, Nov. 28 3:50PM - 4:00PM Room: E261

Participants
Joshua Lorenz, Milwaukee, WI (*Presenter*) Nothing to Disclose
Diane Schott, PhD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Farshad Mostafaei, PhD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Colleen A. Lawton, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Manpreet Bedi, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
X. Allen Li, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Christopher J. Schultz, MD, Milwaukee, WI (*Abstract Co-Author*) Medical Advisory Board, Prism Clinical Imaging, Inc
Eric Paulson, PHD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
William A. Hall, MD, Milwaukee, WI (*Abstract Co-Author*) Departmental research support, Elekta AB

PURPOSE

To investigate changes in quantitative signal variables of organs at risk (OAR) in serially obtained T2-weighted MR images, acquired on an MR-Linac, in patients being treated for prostate cancer.

METHOD AND MATERIALS

Four patients with prostate cancer undergoing treatment with radiation therapy (RT) were compiled from an ongoing prospective observational imaging trial using MR-Linac. All patients provided informed consent for weekly imaging; images were obtained between November 2017 and March 2018. Contiguous sections of rectal and bladder wall adjacent to the prostate were contoured and normalized to temporally corresponding regions of rectum and bladder removed from the planning target volume. Similarly, contiguous axial slices of Sartorius muscle outside of the regions of high dose RT exposure were also contoured as a normal control. The quantitative features considered included: max-to-mean ratio, kurtosis, mean, median, skewness, and standard deviation. A student's t-test was used to evaluate for statistically significant variance week-to-week.

RESULTS

Between weeks 1 and 2, significant variance in the mean and median signal values were seen in sections of rectal wall adjacent to the prostate (p=0.05, p=0.04). Bladder wall near the prostate also exhibited significant variance in the mean and median signal values between weeks 1 and 4 (p=0.05, p=0.04). No significant variance in signal values for the variables considered was observed in the Sartorius muscle control.

CONCLUSION

This is one of the earliest analyses examining quantitative signal value changes in regional organs (bladder and rectum), using an MR-Linac in patients being actively treated with RT for prostate cancer. Significant changes occurred after only 1 week of therapy in regional organs at risk during treatment with RT. Expanded data sets are needed to evaluate if these early changes correlate with clinical outcomes such as acute or late toxicity.

CLINICAL RELEVANCE/APPLICATION

Radiotherapy (RT) response assessment with a 1.5 Tesla MRI may allow for intra-treatment modification of RT plans to increase oncologic control and reduce toxicity. Increased understand of radiomic changes in OAR's will improve RT response assessment.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

MSRO49

BOOST: eContouring (Spinal SBRT)

Wednesday, Nov. 28 4:30PM - 5:30PM Room: S104B

CT NR RO

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Simon S. Lo, MD, Seattle, WA (*Presenter*) Editor, Springer Nature;
Kristin J. Redmond, MD, MPH, Baltimore, MD (*Presenter*) Research support, Elekta AB; Research support, Accuray Incorporated; Speaker, Accuray Incorporated; Travel support, Accuray Incorporated; Consultant, Medtronic plc
William T. Yuh, MD, Seattle, WA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

simonsmlo@gmail.com

LEARNING OBJECTIVES

1) Describe consensus CTV delineation for spine metastases in intact vertebra based on the extent of gross disease. 2) Describe consensus CTV delineation for post-operative spine SBRT including the imaging series most valuable in the contouring process. 3) Describe optimal spinal cord delineation. 4) Explain when CT myelogram may be important in treatment planning for SBRT for spinal metastases.

ABSTRACT

To perform stereotactic body radiotherapy for spinal metastases safely and effectively, proper target delineation based on patterns of failure and practice guidelines and proper spinal cord contouring are paramount. This session will provide guidance for contouring.

SPSC41

Controversy Session: Marginally Operable Stage I Non-small Cell Lung Cancer: Cut or Shoot (Surgery vs Radiation)?

Wednesday, Nov. 28 4:30PM - 6:00PM Room: E353C

CH RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Candice A. Johnstone, MD, Milwaukee, WI (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

cjohnstone@mcw.edu

Sub-Events

SPSC41A Evaluation of Suspicious Lung Nodule: Can Diagnostic Imaging Confidently Diagnose Non-small Cell Lung Cancer?

Participants
Michelle S. Ginsberg, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To discuss imaging features of lung cancer and ability to accurately diagnose lung cancer. 2) To describe CT features of lepidic predominant adenocarcinoma that correlate with invasiveness on pathology.

SPSC41B Case for Surgical Resection

Participants
David W. Johnstone, Milwaukee, WI (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

djohnstone@mcw.edu

LEARNING OBJECTIVES

1) Appraise the current data supporting surgical resection for early stage non-small cell carcinoma of the lung. 2) Understand the definitions of sublobar resection and lobectomy. 3) Compare outcomes between surgical resection and radiation therapy for early stage non-small cell carcinoma. 4) Appraise ongoing clinical trials comparing radiation to surgical resection for early stage lung cancer.

SPSC41C Case of Stereotactic Body Radiotherapy

Participants
Gregory Videtic, MD, FRCPC, Cleveland, OH (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

videtig@ccf.org

LEARNING OBJECTIVES

1) To discuss the approach to the radiographically suspicious lung nodule. 2) To discuss the management options including surgery and radiotherapy to address the suspicious nodule. 3) To discuss the evidence to support radiotherapy in the form of SBRT for the suspicious nodule.

ABSTRACT

TO discuss the clinically controversial question: 'Marginally operable stage I NSCLC:cut or shoot (surgery vs. radiation)?' A diagnostic radiologist will discuss the management approach for the radiographically suspicous lung nodule. A thoracic surgeon will discuss the role of surgery. A thoracic radiation oncologist will discuss the role for lung stereotactic body radiotherapy (SBRT).

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

RC622

Advances in Cone Beam CT Acquisition and Reconstruction in Radiotherapy

Thursday, Nov. 29 8:30AM - 10:00AM Room: S504AB

CT PH RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Douglas Moseley, PhD, Toronto, ON (*Moderator*) License agreement, Modus Medical Devices Inc; Consultant, Elekta AB

Sub-Events

RC622A State of the Art in Advanced CBCT Acquisition and Reconstruction

Participants
Wojciech Zbijewski, PhD, Baltimore, MD (*Presenter*) Research Grant, Carestream Health, Inc; Research Grant, Siemens AG

For information about this presentation, contact:

wzbijewski@jhu.edu

LEARNING OBJECTIVES

1) Identify key challenges to image quality in CBCT. 2) Discuss latest developments in CBCT instrumentation. 3) Describe recent advances in reconstruction algorithms and artifact correction methods for CBCT. 4) Compare CBCT image quality achievable on their systems to state-of-the-art.

RC622B Clinical Need for Advanced CBCT Imaging in Radiotherapy

Participants
Tianyu Zhao, PhD, St. Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Gain greater understanding on the clinical need of CBCT in radiotherapy in the following applications: Image-Guided Radiotherapy (IGRT) with more precise tumor localization and better patient setup, 4D CBCT in managing respiratory motion, and adaptive radiotherapy (ART).

Active Handout:Tianyu Zhao

http://abstract.rsna.org/uploads/2018/18001992/RSNA 2018 handout RC622B.pdf

RC622C Technical Challenges in the Integration of CBCT Imaging into Radiotherapy

Participants
Douglas Moseley, PhD, Toronto, ON (*Presenter*) License agreement, Modus Medical Devices Inc; Consultant, Elekta AB

For information about this presentation, contact:

douglas.moseley@rmp.uhn.ca

LEARNING OBJECTIVES

1) Identify the technical challenges when using CBCT imaging for image-guided radiation therapy. 2) Discuss strategies for commissioning and QA of the IGRT workflow in the clinic. 3) Describe the future direction of in-room image guidance.

ABSTRACT

The Scan-Plan-Treat paradigm is becoming too simplistic to do describe the workflow in the modern radiation therapy clinic. Multiple CBCT scans are performed during the treatment delivery that may trigger, re-Scans and re-Plans. This presents several challenges.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

ROS-THA

Radiation Oncology Thursday Poster Discussions

Thursday, Nov. 29 12:15PM - 12:45PM Room: RO Community, Learning Center

RO

AMA PRA Category 1 Credit ™: .50

Participants
Edward Y. Kim, MD, Seattle, WA (*Moderator*) Nothing to Disclose

Sub-Events

RO226-SD-THA1 Correlation Study Between Parameters of Intravoxel Incoherent Motion Diffusion-Weighted Imaging and Different Pathological Differentiation of Cervical Squamous Cell Carcinoma

Station #1

Participants
Lixiang Zhang, Hefei, China (*Presenter*) Nothing to Disclose
Fei Gao, Hefei, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the correlation between parameters of intravoxel incoherent motion diffusion-weighted imaging and different pathological differentiation degree of cervical squamous carcinoma.

METHOD AND MATERIALS

Retrospective analysis of 87 cases patients of cervical squamous cell carcinoma confirmed by surgery and pathology in our hospital, including fifty cases were in the low differentiation group(Fig A1-A7), twenty-six cases were in the middle differentiation group(Fig B1-B7) and eleven cases were in the highly differentiation group(Fig C1-C7). Intravoxel incoherent motion diffusion-weighted imaging was performed by using 10 b values(b=0,10,20,50,100,200,400,800,1200,2000s/mm2). Statistical analysis software SPSS 22.0 was used in cervical squamous cell carcinoma diffentiation.The receiver operating characteristic curve (ROC) was used to investigate efficiency of differentiation of cervical squamous cell carcinoma.

RESULTS

The ADCstand, D, D*and f values of low differentiation degree group were (0.72±0.11)×10-3mm2/s, (0.45±0.067) ×10-3mm2/s, (7.56±3.09) ×10-3mm2/s and (39.55,14.25)%; The ADCstand, D, D*and f values of middle differentiation group were (0.74±0.11)×10-3mm2/s, (0.58±0.036)×10-3mm2/s, (17.19±4.37) ×10-3mm2/s and (24.05,3.73)%; The ADCstand, D, D*and f values of highly differentiation were (0.78±0.073) ×10-3mm2/s, (0.74±0.024) ×10-3mm2/s, (39.18±10.09) ×10-3mm2/s and (18.70,1.60)%; There are statistical significance in the D, D*and f values of between different groups(P<0.05),but there is no statistical significance in the ADCstand of between different groups(P=0.19). The D and D* values were positively correlated with the pathological differentiation of squamous cell carcinoma (r was 0.853,0.880), and the f value was moderately negative correlation (r = -0.730). The D value has the best diagnostic efficiency in the diagnosis of low differentiation and high differentiation of cervical squamous cell carcinoma; the f value has the best diagnostic efficiency in the diagnosis of cervical squamous cell carcinoma.

CONCLUSION

The D, D * and f values of IVIM-DWI can non-invasively assess the pathological differentiation degree of cervical squamous cell cancers.

CLINICAL RELEVANCE/APPLICATION

It is helpful for the clinician to develop individualized treatment plans of cervical cancer to improve the efficacy.

RSNA 2018 TOMORROW'S RADIOLOGY TODAY
104th Scientific Assembly and Annual Meeting
November 25–30 | McCormick Place, Chicago

ROS-THB

Radiation Oncology Thursday Poster Discussions

Thursday, Nov. 29 12:45PM - 1:15PM Room: RO Community, Learning Center

RO

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Edward Y. Kim, MD, Seattle, WA (*Moderator*) Nothing to Disclose

Sub-Events

RO227-SD-THB1 Development and Implementation of the In-Vivo Dosimeter for High-Dose-Rate (HDR) Ir-192 Brachytherapy Using Optically Stimulated Luminescence Dosimeters (OSLDs) : Evaluation of Rectal Dose in Clinical Cases

Station #1

Participants
Yoshinori Miyahara, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Atsushi Ue, Izumo, Japan (*Presenter*) Nothing to Disclose
Mutsumi Tokudo, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Yuki Imoto, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoko Hieda, MD, PhD, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Yukihisa Tamaki, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasushi Yamamoto, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Hajime Kitagaki, MD, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Taisuke Inomata, MD, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Evaluation of rectal dose is an important factor in HDR brachytherapy within the pelvis. And the nanoDotTM OSLD (Al2O3 :C) is a new type of in-vivo dosimeter. Purpose of this study is to measure the rectal dose in HDR brachytherapy using OSLDs.

METHOD AND MATERIALS

Initially, the calibration curves of the OSLDs for high-energy gamma-ray (from 0.1 to 8.0 Gy) were measured by using 10×10×10 cm3 prototype water phantom. And also angular dependence was measured. Production of rectal dosimeter and its measurement are as follows: Three light-shielded OSLDs sheets (height 10.0 × width 19.0 mm per sheet) were tightly fixed at 1.0 mm spacing as to be circular form to a flexible catheter (Nelaton catheter of outside diameter 6.0 mm) which can insert the X-ray opaque catheter marker. Treatment planning was conducted by semi-orthogonal method from both frontal and lateral images, and the OSLDs were placed at the high-dose region of the rectum. In analysis of rectal dose in OSLDs, nine cut dots (circle of diameter 5.0 mm) were measured from three sheets (three dots per one sheet of a step). The difference between the planned dose (at X-ray opaque catheter marker) and the average dose at each step were evaluated. Immobility of inserted rectal dosimeter was confirmed from the X-ray images after the irradiation. These dosimetries were conducted on RALS treatment (prescription dose: 6.0 Gy) of cervical cancer for nine cases.

RESULTS

The calibration curve (y=95141x-20703) was determined between OSLDs counts and Ir-192 doses. We estimated the uncertainty (angular dependence, reproducibility, and systematic variation) of this rectum dosimeter to be 15%. Identification of the position of the OSLDs with the 2D image was difficult. In the first four cases, a difference of about 1.0 Gy was observed between the planned value and the OSLD. However, in the following five cases, rectal doses were almost equivalent (P=0.79, Welch's t test) by placing a point markers on the top of the OSLDs for position identification.

CONCLUSION

This OSLD rectal dosimeter is flexible and non-invasive. The feasibility of OSLD as an in-vivo dosimeter in HDR brachytherapy was verified.

CLINICAL RELEVANCE/APPLICATION

By using a flexible in-vivo dosimeter, it becomes possible to measure the actual rectal dose, and the treatment can be performed safely.

RC722

Machine Learning for Radiotherapy Applications

Thursday, Nov. 29 4:30PM - 6:00PM Room: N227B

AI PH RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Jayashree Kalpathy-Cramer, MS, PhD, Charlestown, MA (*Moderator*) Consultant, Infotech Software Solution

Sub-Events

RC722A Deep Learning for Image Segmentation, Analysis and Reconstruction

Participants
Jonas Teuwen, MSc,PhD, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jonas.teuwen@radboudumc.nl

LEARNING OBJECTIVES

1) Learn about the types of clinical problems which are best suited for deep learning solutions. 2) Learn about the current state-of-the-art deep learning technology in the analysis and segmentation of medical images, and learn about the advantages of reconstructing images using deep learning technology. 3) Being able to critically estimate the impact and assess the applicability of newly developed deep learning technology.

ABSTRACT

Deep learning has recently attracted much interest from the medical community, mainly due the successful application to problems which were previously considered to be purely within the human realm. The availability of an ever growing amount of medical images, and the increasing availability of affordable computation resources allows to apply deep learning technologies to many different problems. However, the scope of problems for which deep learning currently performs on par or outperforms humans is rather narrow. The required human and financial effort makes it important to be able to determine clinical problems where deep learning could bring an advantage. After this refresher course, you will be aware of the state-of-the-art in deep learning for image segmentation, analysis and reconstruction. You will be able to critically assess the impact and applicability of deep learning technology and be able to find future clinical opportunities.

RC722B Machine Learning Tumor Classification

Participants
Jayashree Kalpathy-Cramer, MS, PhD, Charlestown, MA (*Presenter*) Consultant, Infotech Software Solution

For information about this presentation, contact:

kalpathy@nmr.mgh.harvard.edu

LEARNING OBJECTIVES

1) Learn about applications of machine learning including radiomics and deep learning in classifiying tumor sub-types. 2) Learn about risk stratification using machine learning of MR and CT images. 3) Understand the challenges when applying machine learning to tumor analysis. 4) Review best practices for applying machine learning in cancer imaging.

ABSTRACT

Machine learning has shown great potential for a range of applications in oncology from diagnosis to therapy planning and response assessment. Large repositories of clinical and imaging data typicially available at most institutions can be be used to train and validate models. We will discuss the use of machine learning including radiomics and deep learning for the analysis of CT and MR imaging in a variety of cancer types for risk stratification, radiogenomics and response assessment..

RC722C Machine Learning for Automated Treatment Planning

Participants
Laurence E. Court, PhD, Houston, TX (*Presenter*) Nothing to Disclose