

Image Guided Cancer Therapy: Image Guidance in Radiation Therapy

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Successes in Partnership between Rad Onc & Medical Physics over time: What's next?



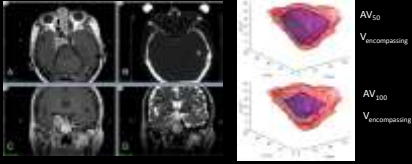
Utilization of Imaging: Moving Beyond the Art



Major Challenge: Defining goals
Defining ground truth

Variability in Segmentation by Humans

- 16 participating GK centers
- Axial and coronal T1-w, coronal T2-w and CT (bone-window) images were provided for target delineation



Humans are inconsistent
Limited understanding of what we are visualizing

Sandstrom-Acta Neurochir 2014

Working towards the 'Ground Truth' in Imaging

- Collaborative effort between therapy (RO, SO, MO, IR), diagnostic imaging and pathology

Digital pathology



Anatomical/Functional Imaging

- Target Definition for RT
- Enable serial non-invasive biological imaging interpretation for personalized therapy adaptation

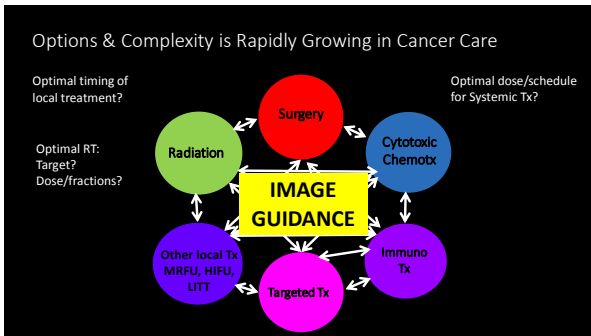
To see or not to see... Visualizing Complex Data



We need to evolve the Medical Profession

Medical Physics - we need your help!

'Practice of Medicine' Data-driven Clinical Optimization



Quantitative Data-Driven Medicine

Predictive/Prognostic factors

- Known variables
- Unknown variables

Investment: need to build the infrastructure

Gain: Efficient, complete, consistent data collection

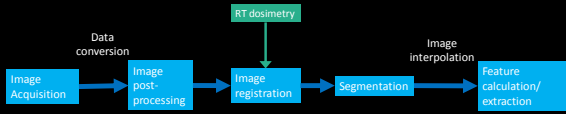
- Validate 'known' variables
- Discover 'unknown' variables

Standardization

Quality Control

Technology Infrastructure

Challenges of Quantitative Imaging Biomarkers



- Variability at each step introduces a layer of challenge in validating & clinically implementing a biomarker

Standardized measurement is key

Standardizing Image Acquisition

- QIBA profiles
- Phantom studies
- Clinical trials protocols:
 - Imaging credentialing – phantom
 - Standardized imaging protocols – central review for compliance
 - Central image interpretation
- Potential power of working with vendors to develop QI solutions for image acquisition (i.e. minimize human error/variability)

Consensus recommendations for a standardized Brain Tumor Imaging Protocol in clinical trials

Margareta M. Ellingson, Martin Bendszus, Jerrold Boxerman, David Borsook, Bradley J. Erickson, Martin Frohlich, Sarah J. Nelson, Elizabeth Scahill, Brian Alexander, Gregory Galbraith, Wolfgang Hück, Michael Vogelstein, Michael Walke, Evonkie Balkas, Jayachandran Rajagopal-Chandrasekhar, LaBiba Swettenham, Paula Jankovic, William R. Pope, Qianqian Song, Corinna Chung, Michael V. Knopp, Susanna Cho, Martin J. van den Bergh, Susan Chang, W.R. Al Yang, Timothy P. Hawley, Patrick Y. Wen, Mark R. Gilbert, and the International Brain Tumor Imaging Development/Validation Imaging Standardization Steering Committee

We need to standardize MRI acquisition protocols

- Most clinical MRI sequences are T1 or T2 "weighted"
- Lesion contrast is highly dependent on sequence parameters
- Lesion size is subjective due to ability for reader (or algorithm) to generalize across levels of image quality
 - Think about this for radiation planning, ROI-based QI, radiomics

Neuro-Oncology 2015

Imaging in Radiation Oncology: What is on the horizon?

WHAT?

- Automation to minimize human errors & improve efficiency
- Image-guidance for target & OAR definition
- Optimizing treatment determination & timing

HOW?

- Redefining 'multidisciplinary team' & traditional roles in medicine
- Development of tools that encourage adoption of technology
- Pursue data-driven approaches

*" Life is like riding a bicycle.
To keep your balance,
you must keep moving. "*

~Albert Einstein



Why you should work smarter not harder



