IMRT/IGRT Patient Treatment: A Community Hospital Experience

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I have no research support or financial interest to disclose.
1. Review a typical IMRT/IGRT implementation process.

2. Have an understanding of IMRT/IGRT program development at High Point Regional Hospital.

3. Understand the elements of our IGRT system quality assurance program.
▪ 400 Bed Community Hospital

▪ Radiation Oncology Department
  ▪ External Beam Therapy
    ▪ 340 New External Beam Patients each Year
    ▪ Average Daily census: 35 patients
    ▪ PET-CT Simulator
    ▪ MLC based IMRT & 3D conformal
    ▪ Two accelerators: One with KV Imaging capability

▪ Brachytherapy program includes:
  ▪ HDR – Prostate, Partial Breast, Lung, GYN
  ▪ LDR – Prostate seed implants
IGRT Committee

- **Membership:** medical director, physicist, dosimetrist, therapist, and administrative director

- **Exhaustive literature review**
  - Body sites that benefit from IGRT
  - Process: implantable markers, 2D imaging, CBCT
  - Immobilization
  - Margin reduction, dose escalation
  - Quality assurance of equipment and treatment
  - Inter vs Intra fraction motion and repeat imaging
Results of Literature Review

- **Major Reality Check**
- Prostate and H & N IMRT patients may benefit most

IGRT Billing Requirements

- Level of physician supervision
- Documentation of daily correction
- No portal images
- Who implants markers? Who pays for markers?
Implementation Process

- Prostate IMRT/IGRT
  - 2D (AP & LAT) Marker Position Match Preferred
    - Superior to bony anatomical matching
    - Superior to CBCT because soft tissue delineation is relatively poor

- Urologist places gold seeds in office

- Daily patient shift/correction is documented on patient specific Excel spreadsheet
### Shift Calculation for IGRT

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<th>Date</th>
<th>Physician Initials</th>
<th>Therapist Initials</th>
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<th>Lng  (cm)</th>
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**Criteria for Shifting**
- < 0.50 cm: shift
- < 1.50 cm: shift and reimage
- > or = 1.50 cm: call physician
Prostate Mean Vector Correction Analysis

- Inter-Fraction
- Intra-Fraction

Patient Number

Magnitude (cm³)
H & N IMRT/IGRT

- Immobilization
  - Minimize rotational setup error – custom head holder
  - Use S-frame immobilization to fix head, neck, and shoulders

- Imaging (CBCT) Frequency
  - O.A. Zeidan et al – review of several different imaging protocols
  - CBCT every other day
  - Use running mean of CBCT shift on non-imaging treatment days
H & N IMRT/IGRT

What about changes as treatment progresses?

Physician reviews anatomical changes/surface contours relative to Tx Plan CT weekly

- <= 0.5cm – No Action
- 0.5cm > 1.5cm – Dosimetric review at discretion of MD
- >= 1.5cm – re-mask, re-scan, & dosimetric review of current IMRT plan
  - Move forward with current plan or re-plan and implement within 3-5 fractions (no break)
H & N IMRT/IGRT

▪ What do we align data set to?
  ▪ Physician discretion
  ▪ Standard initial alignment to C-6 and/or clivus
  ▪ Contour C-6 on Tx plan CT

NOW WE ARE READY TO START H&N IGRT USING CBCT!
Can we use IGRT on “This Patient”? 

IGRT can be a benefit to many patients but…..

- Different body sites need different criterion
- Soft tissue alignment can be difficult – do you implant markers?
- How much inter-fraction motion is expected?
- How much intra-fraction motion…gating?
A quality assurance program for the on-board imager

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(Received 9 June 2006; revised 20 September 2006; accepted for publication 20 September 2006; published 31 October 2006)
Program Elements

- Safety and Functionality QA
- Geometrical Accuracy QA
- Image Quality QA
Daily QA Tests

- Verify the functionality of all safety systems
  - Door Interlock
  - Warning Lights
  - Collision Interlocks

- Imaging Isocenter Accuracy

- Couch shift/positioning Accuracy

- Adds about 15 mins to daily accelerator QA
 Monthly QA Tests

- Magnification Accuracy
- Imaging Arm Positioning Integrity
- Imaging Isocenter accuracy versus Gantry Angle
IGRT System Quality Assurance

- Quarterly/Annual QA Tests
  - CBCT Image Quality
    - HU reproducibility
    - Low Contrast Resolution
    - HU Uniformity
    - In-slice spatial linearity
    - Slice thickness accuracy
Thank You for Your Attention!


