IMRT/IGRT Patient Treatment: A Community Hospital Experience

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Disclosures

I have no research support or financial interest to disclose.

Learning Objectives

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.**

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HIGH POINT REGIONAL HOSPITAL

- 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

Implementation Process

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

Implementation Process

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**

Implementation Process

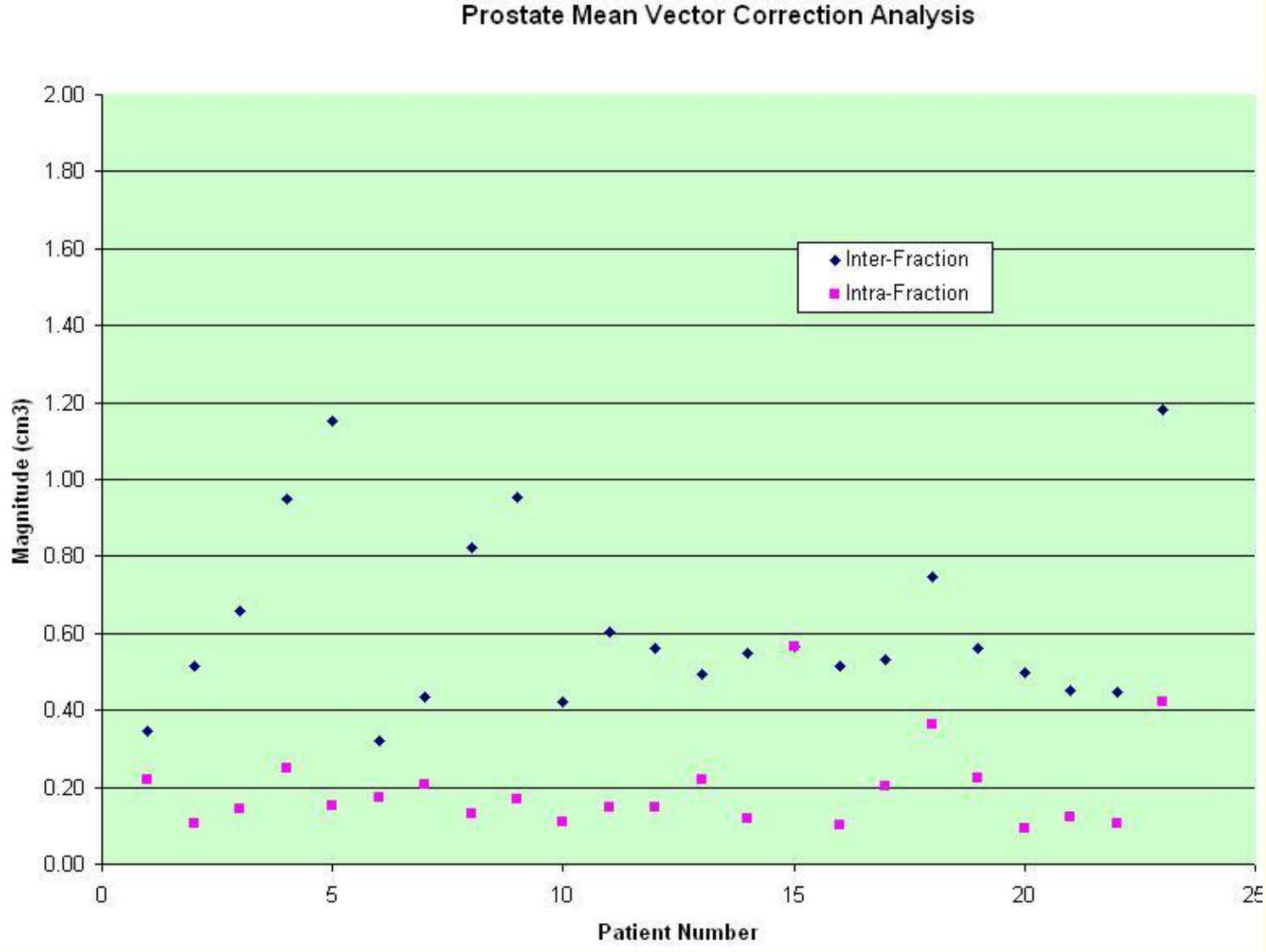
Shift Calculation for IGRT

Criteria for Shifting

Patient:		< 0.50	cm: shift
MR#:		< 1.50	cm: shift and reimage
		> or = 1.50	cm: call physician

Date	Physician Initials	Therapist Initials	Vert (cm)	Lng (cm)	Lat (cm)	Calculated Vector Shift (cm)
10/10/2007	BF	CF	-0.9	0.9	-0.2	1.29
10/10/2007	BF	CF	-0.1	0.1	0	0.14
10/11/2007	BF	CF	-1.2	0.8	-0.4	1.50
10/11/2007	BF	CF/LL	-0.1	0.3	0	0.32
10/12/2007	JP	LL	-1.7	0.9	0	1.92
10/12/2007	JP	LL	0.2	0.1	-0.1	0.24
10/15/2007	bf	ll	-1.6	0.8	-0.3	1.81
10/15/2007	bf	ll	0	0	0	0.00

Program Development



Implementation Process

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

Implementation Process

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)**

Implementation Process

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!

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Program Development

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?**

IGRT System Quality Assurance

A quality assurance program for the on-board imager®

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IGRT System Quality Assurance

Program Elements

- **Safety and Functionality QA**
- **Geometrical Accuracy QA**
- **Image Quality QA**

IGRT System Quality Assurance

- **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 15mins to daily accelerator QA**

IGRT System Quality Assurance

- **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**

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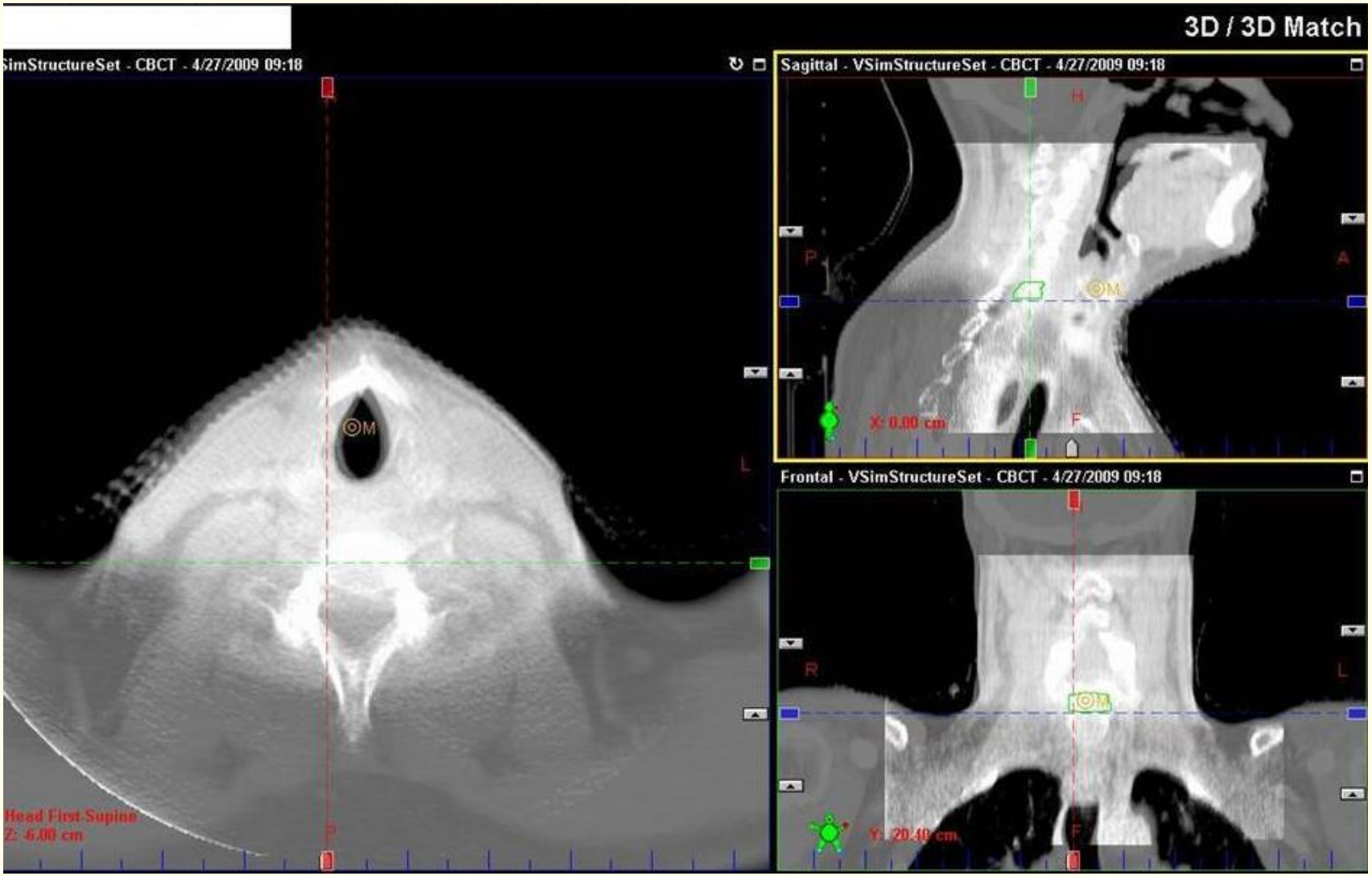
Thank You for Your Attention!



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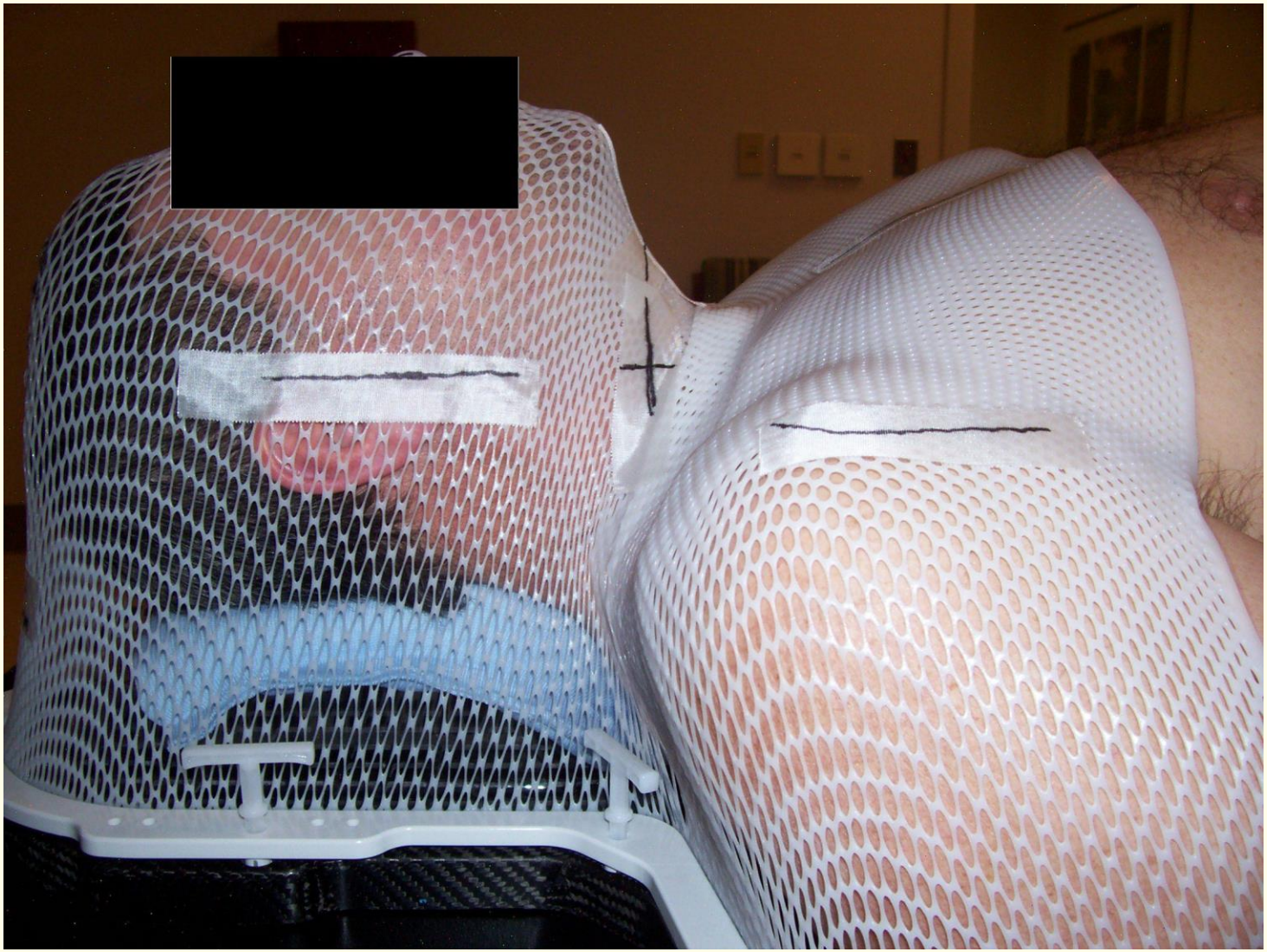
Implementation Process



Program Development