IMRT PROCESS AND WORKFLOW

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Introduction

• LohGuanLye Specialists Centre (LSC), Penang started IMRT in Year 2010
  – First case was NPC
  – Average 4 – 5 IMRT cases a month
    • Mostly NPC cases

• This talk is based on my Centre’s IMRT Workflow and Process.
IMRT Process and Workflow

- Immobilization
- Imaging
- Treatment Planning
- Pre-treatment Verification
- Treatment

Psst… almost the same as 3DCRT
In the Beginning...

• Consultant identifies suitable patients for IMRT
  – Beneficial to Patient
  – Patient agrees and meets the financial requirement

• Appointment for Imaging
  – CT Planning or PET-CT Planning (optional)
  – MRI Planning (optional)
IMRT Process and Workflow

Immobilization
Immobilization

• Remember that the immobilization devices that you use must be
  – Easy to use
  – Quick to setup
  – Restrictive but Comfortable
  – Durable to withstand the entire radiotherapy course
Immobilization

• A Customized immobilization device is a must for all IMRT patient.

• There are a few brands to choose from
  – Civco
  – Orfit
  – Klarity
Immobilization

• In LSC, we positioned the patient; supine with extended Neck with the following items:

  Thermoplastic  Vacuum Cushion  Shoulder Retractor

Psst… Remember thermoplastic shrinks
IMRT Process and Workflow

Immobilization

Imaging
Imaging

• The Radiotherapy dept does not own a CT Scan machine. We share with the Radiology Unit.

• We use the CT component of PET-CT machine for all planning case
  – Cost effectiveness

• For our IMRT planning cases;
  – CT planning or PET-CT planning
  – MRI planning
Imaging

- CT Scan with Patient in treatment position with all the Immobilization devices
  - CT scan with Flat Board
  - Positioning Lasers
  - Contrast (optional)
  - Set reference point
  - Diagnostic Scanning Protocol
Imaging

• PET-CT Planning
  – Both metabolic and physiology information
  – Easier to identify the GTV
  – Improves agreement between oncologist
Imaging

• MRI Planning
  – Still requires CT Planning
    • Fantastic fusion results especially for H&N
  – With flat board and immobilization device
  – Not suitable for claustrophobic patients
Imaging

• MRI Planning
  – 2 sequence
    • $T_2$ fat suppress
    • $T_1$ MPRAGE (post contrast)
  – Very helpful for contouring both OAR and GTV
IMRT Process and Workflow

1. Immobilization
2. Imaging
3. Treatment Planning
Treatment Planning

- Image Import
- Fusion
- Contouring
- Planning / Optimization
- Download images to TPS
- Planning Images
- Staging Images (if any)
- Pre-chemo images (if any)
Fusion of all images
Primary image set: CT Planning
Fused to Primary area (especially for NPC)
Contouring

- OAR and PTV contouring
- LSC practices
  - Simultaneous Integrated Boost (SIB)
- Multiple PTVs
- PTV manipulation
  - Boolean Operation
  - PTV drawn too near the skin

References for contouring:
- Ivan Tham et al, IJOBP 75 (5), 2009
- RTOG contouring atlas (for neck nodes)
- A Guide for Delineation of Lymph Nodal Clinical Target Volume in Radiation Therapy, Ausili Cefaro, Springer
- Rafael Martinez-Monge et al, Radiology 211, 1999
- QUANTEC
• Split field IMRT / Continuous IMRT
  • Aruna Turaka et al, IJROBP, 79 (1), 2011
• 7F / 9F IMRT or Arc IMRT
  • LSC uses 7F IMRT
  • 5F – unsatisfactory results
• Bolus?
• Artifact
  • Tooth filling and contrast
• Constraints
  • Perez & Brady, 5th Edition, pg 840 (for NPC)
    • Pamela Youde Nethersole Eastern Hospital, HK
  • QUANTEC
  • Ivan Tham et al, IJOBP 75 (5), 2009
• “Help” structures
• “Skin flash”
IMRT Process and Workflow

- Immobilization
- Imaging
  - Pre-treatment Verification
  - Treatment Planning
Pre-Treatment Verification

• Patient specific QA

• Pre Treatment Imaging
Patient Specific QA

- Patient specific QA is verification of an IMRT plan.
  - Are the doses predicted by the TPS similar to what you measure?
  - Should be checked before treatment / within first 5 fraction.
- ‘Real time’ measurement
  - MLC log file
  - TLD
Patient Specific QA

• ESTRO BOOKLET No 9 – Guidelines for the Verification of IMRT
  – Dosimetry System
  – Patient Specific QA in 10 different centres (in Europe)
  – Guidelines
Patient Specific QA

• LSC utilizes
  – “Point” Dose – 0.125cc Ion Chamber with CIRS phantom
    • At least 3 points
      – High Dose & low dose region
        » Dosimetry Leaf Gap / MLC leakage
    • Compare TPS results with measured results
      – Mean Dose of the chamber
  • Tolerance: ± 5%
    – Most deviation is within ± 3%
Patient Specific QA

- LSC utilizes
  - Actual gantry angle
    - if exceed tolerance, able make a better decision.
Patient Specific QA

- LSC utilizes
  - Portal Dosimetry
    - Performed for all the fields
      - Actual gantry angle
    - Analyzed using 3rd party software (RIT)
    - Criteria: 3mm DTA / 3% Dose Differences
      - Gamma Index > 97% pass
      - DTA > 90% pass
      - Dose Differences > 80% pass
Patient Specific QA
Patient Specific QA
Patient Specific QA
Pre–treatment Imaging

- Various pre–treatment imaging solutions in the market
  - Exactrac
  - MVCT
  - OBI (CBCT)

- Purpose: To provide the users with images in pretreatment position
Pre-treatment Imaging

• Our LINAC has a OBI with CBCT capability
• LSC protocol for all IMRT cases
  – Daily Imaging
    • CBCT for first week of treatment
    • Then CBCT, once a week
    • Orthogonal images in between
  – Correct for all deviation unless matching not possible
    • Then reposition the patient
IMRT Process and Workflow

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Treatment

• During treatment,
  – Weekly review by the ENT and oncologist

• Patient must complete the treatment within 6.5 weeks
  – Treatment on Saturdays (if necessary)
Thank you!