Importance of daily portal imaging for Head and Neck IMRT treatments

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Overview

- Head and Neck IMRT treatments
- Immobilization for Head and Neck IMRT treatments
- Daily Portal Imaging
- Retrospective study of Isocentric shifts and Superclavicular shifts
- Results
- Other positioning issues
- Future immobilization devices
3D-CRT

Tumor volume expansion 1cm

IMRT

Tumor volume expansion 5mm
Head and Neck Immobilization

Indexed base-plate

Acuform patient-specific headrest
Head and Neck Immobilization

Thermoplastic head-neck-shoulder mask (S-Type, Medtec)
Location of Head and Neck
tumor volumes

C2
Image-guided head and neck radiation therapy(1)
Image-guided head and neck radiation therapy(1)

• Therapists compare daily images with DRRs
Image-guided head and neck radiation therapy (1)

- Digital portal images taken daily
Daily Imaging Dose

• Need to include imaging dose (1.5-2Gy) in evaluation of final plan
• Imaging dose included in IMRT optimization as a base plan
Image-guided head and neck radiation therapy (2)

- Shifts Happen!
Isocentric Shifts

- At Isocenter, shifts are made using 3mm action level
- Patient repositioned in mask if considered necessary
- Patient repositioning noted by therapists in the treatment chart
Isocentric Shifts

- Vertical
- Longitudinal (head towards gantry)
- Lateral
Supraclavicular Shifts

- At the Supraclavicular (SCV) level, portal images are repeated if shoulders are shifted.
- SCV shifts start to appear for the later part of the patients treatment.
- Shifts are made only in a lateral direction.
- Whole process adds around 3 minutes to treatment time.
Supraclavicular shifts

8cm below ISO
Retrospective study of isocenter and supraclavicular shifts (1)

- Review of 15 patients for isocentric shifts
- Use couch coordinates from IMPAC record and verify
- Difference between couch coordinates for imaging and treatment gives magnitude and direction of shift

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Shifts at isocenter: Results

- Isocenter discrepancies of 3mm or smaller in any direction were recorded for a median of 92.5% of the fractions (range: 71.4-100%)

- Isocenter shift larger than 5mm were recorded twice: 2 patients, 1 fraction each (0.38% of all of the fractions)
Retrospective study of isocenter and supraclavicular shifts (2)

- Review of 10 patients for supraclavicular shifts
- Size of SCV (8cm below iso) repositioning evaluated retrospectively by experienced therapist
How often is a SCV shift needed?

Patients were repositioned in the immobilization mask before treatment for a median of 14% of the fractions.
Size of SCV shifts

59% of the SCV shifts were less than 5mm
30% of the SCV shifts were 1cm or larger
Direction of SCV shifts

• Shifts (for given patient) are always in same direction
• 50% of patients had all shoulder shifts in left direction
• 50% of patients had all shoulder shifts in right direction
Dosimetric impact of SCV shifts

- For IMRT plans (5mm margins), a 1cm lateral shift in the SCV region can reduce the dose to the target volume by as much as 25%.

- Daily imaging is therefore important to prevent reduced doses to inferior target volumes.
Other positioning issues

• Supraclavicular positioning issues dominate
• Occasional jaw and neck positioning issues, caught by daily portal imaging
• Usually because patient pushed into mask differently
Summary

• With current immobilization, daily isocenter positioning is excellent
• Supraclavicular positioning is more variable
• Important to evaluate daily portal images for entire treatment volume – not just isocenter
• Daily imaging is essential for accurate delivery of IMRT
• Currently evaluating different immobilization techniques
Future Immobilization Devices

Head-neck-shoulder cast (Medtec Vaculoc)

- Eliminates the use of a custom head rest