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Isotoxic Radiotherapy for Non-Small Cell Lung Cancer: Is IMRT the Answer?

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Introduction

- What is isotoxic radiotherapy?
- Why Non-Small Cell Lung Cancer (NSCLC)?
- Planning study and methodology
- Early Results
- Conclusion

Radiotherapy prescription dose

- All patients receive the same prescription
- Safe and effective over a *population*
- Current practice - 66Gy in 33 fractions
- Individual disease and anatomy may not suit!

What is isotoxic radiotherapy?

- Prescription dose is individual to the patient
- Maximum risk of toxicity is standardised
- Dose to the tumour is not limited
  - *Provided that normal tissue tolerance is not exceeded*
- E.g. 1 person recieves 66 Gy, another 79 Gy due to the mean lung dose

Why isotoxic RT in NSCLC?

- Local control is a problem
- Survival is linked to local control
- Radiation dose improves both (Kong 2005)
- Size of lungs/proximity of spinal cord varies from patient to patient

Isotoxic RT in NSCLC


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JOURNAL OF CLINICAL ONCOLOGY ORIGINAL REPORT
Mature Results of an Individualized Radiation Dose Prescription Study Based on Normal Tissue Constraints in Stages I to III Non–Small-Cell Lung Cancer

- Max dose 79 Gy (1.8 Gy bd) (BED~100Gy)
- Favourable results
- Did not use IMRT

Design of planning study

- Will IMRT allow more patients to reach 79 Gy?
- What patient characteristics determine the level of escalation?

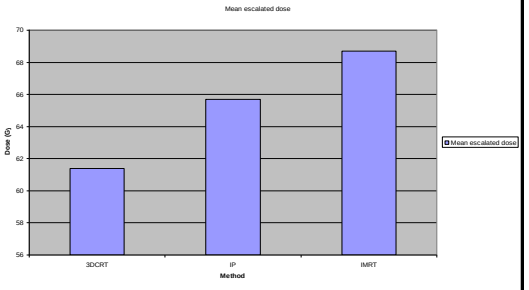
Methodology

- Retrospective planning study
- 20 patients
- Stage II and III
- 3 methods: IMRT, 3DCRT and IP
- Dose escalated until OAR tolerance dose reached

Early results

- Max dose reached =70.2 Gy (Equivalent 80Gy 2Gy/fraction Mon-Fri)
- 15/20 IMRT vs 5/20 3DCRT/IP
- Mean dose higher for IMRT

Mean escalated dose

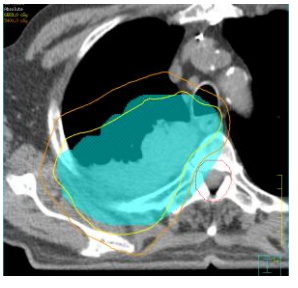


Organs at risk

- 0 patients reached 79 Gy
- Major airways and great vessels dose limiting for IMRT
- Mean lung dose limiting for 3DCRT and IP

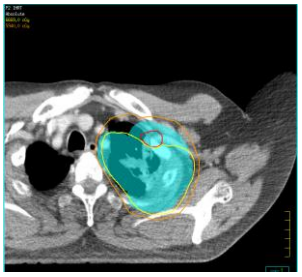
Organ at risk sparing: spinal cord

- IMRT allows sparing of some normal tissues
- Spinal cord spared high dose
- Key
  - yellow= 67 Gy
  - orange= 54 Gy
  - Light blue= PTV



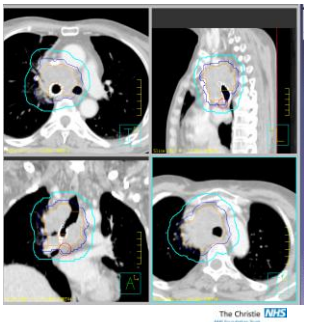
Organ at risk sparing: brachial plexus

- Higher doses reached with IMRT
- Small volume of overlap essential
- All of the PTV treated to 59 Gy
- Most of PTV reaching 67 Gy
- Key
  - yellow = 67 Gy
  - orange = 59 Gy
  - light blue = PTV
  - red = brachial plexus



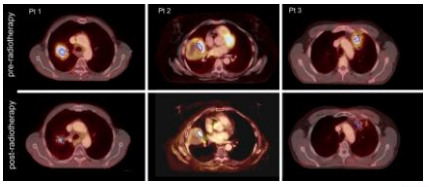
Organ at risk sparing: Great vessels and main bronchus

- Maximum dose of 74 Gy
- Stage II and III disease large and/or central
- Overlap region between OAR and PTV too great



Future work

- Further escalation through margin reduction
- Could we escalate dose to just part of the PTV?
- PET fusion could allow a refined 2 dose-level IMRT solution.



Conclusion

- Distinct advantage with IMRT
- Further analysis of patient characteristics
- Clinical pilot study
- Future PET fusion/dose escalation trial with the European ARTFORCE Consortium

  (Max dose ~130Gy)