

Discussant for Protons in Lung Cancer

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The logo for Washington University in St. Louis School of Medicine, featuring a red and white crest with a shield and a cross, followed by the text "Washington University in St. Louis" and "SCHOOL OF MEDICINE" in a serif font.

Disclosure



Objectives of Radiation Therapy

- Primary: Maximize local tumor control
- Secondary: Minimize normal tissue effects

Maximize tumor control - lung

■ X-rays

- Local control is poor with 60-66 Gy
- Are recent applications better?
 - Dose escalation
 - IMRT
 - IGRT

■ Protons

- Unknown local control vs x-rays
- Greater uncertainty of dose hitting target

Minimize toxicity - Lung

■ X-rays

- Known normal tissue tolerances
- Lung is fairly sensitive to low doses of XRT

■ Protons

- Probably advantageous for normal tissue avoidance
- Except for tissues that are near the distal falloff!

Stage I NSCLC - ASTRO 2009

■ Local control rates

- SBRT photon (Cooperative group data) = **>90% at 2 years**
- Proton/Carbon ion = **83% at 3 years**

Prospective trials are important!

Uncertainties of proton dose in lung

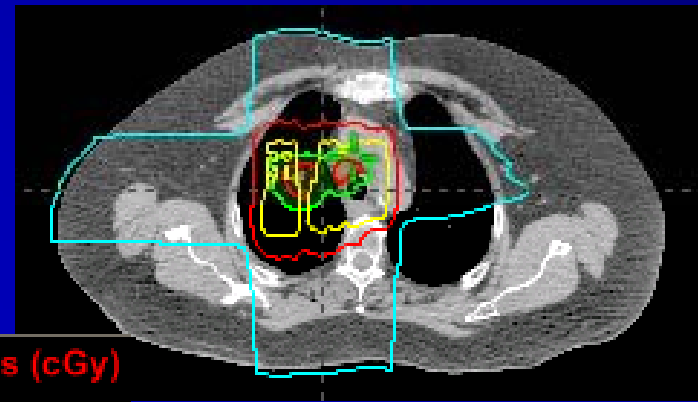
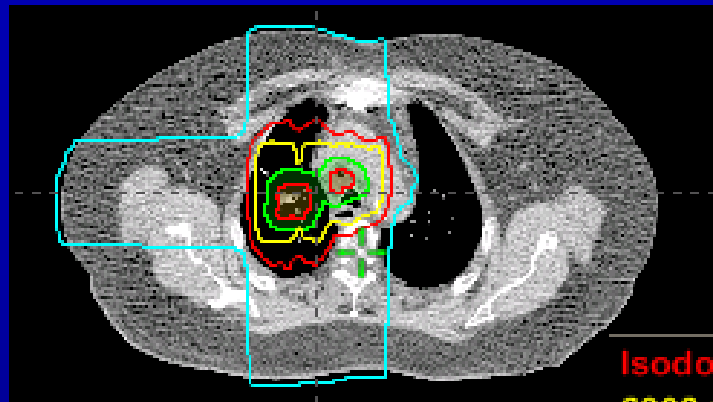
- Tissue-air interfaces
 - Tumors near mediastinum and liver
 - Too much dose to esophagus?
- Target changes
 - Tumor Motion
 - Tumor Response
 - Shrinkage, central necrosis, etc.

CTV coverage drops from 99% to 92.3% with proton but not in IMRT

Planned

Week 7

proton



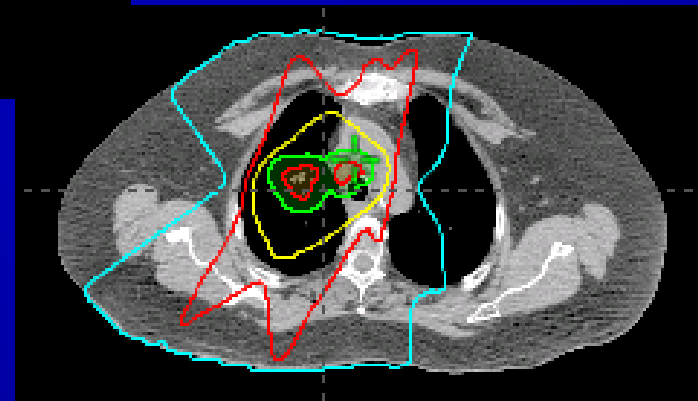
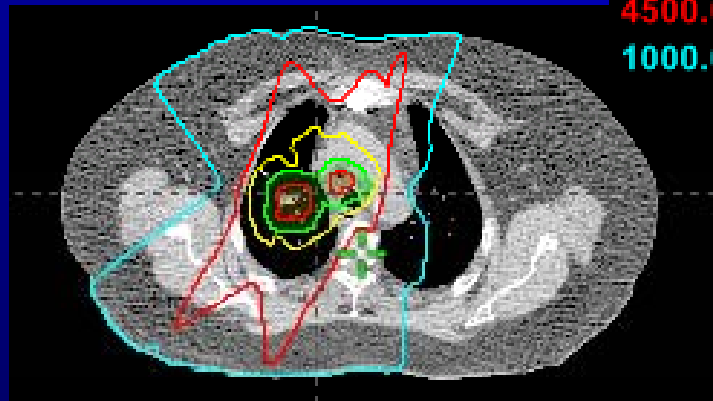
Isodoses (cGy)

6300.0

4500.0

1000.0

IMRT

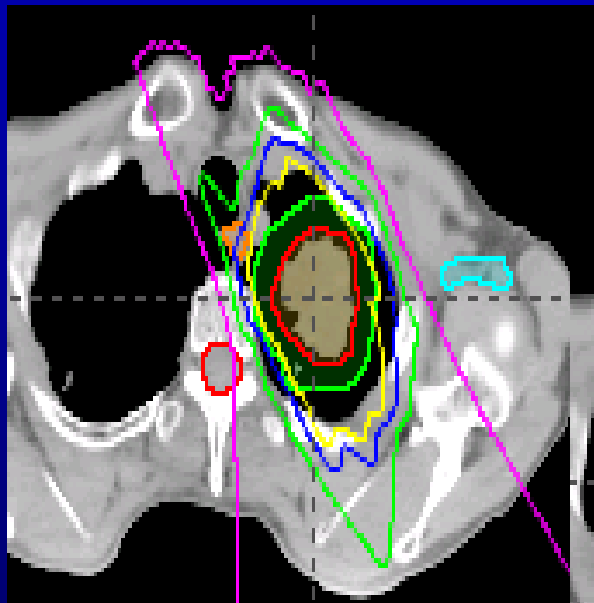


(Hui and Chang et al: Int J Rad Onc Biol Phy. 2008 in press)

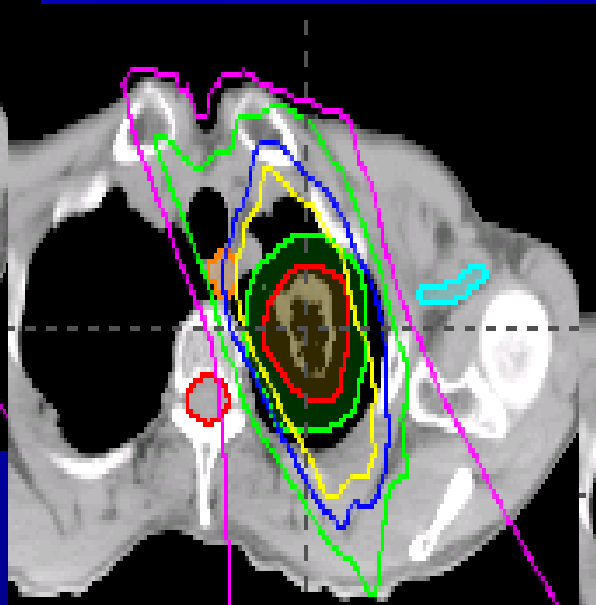
Adapted proton therapy

87.5 CGE in T2N0M0 NSCLC

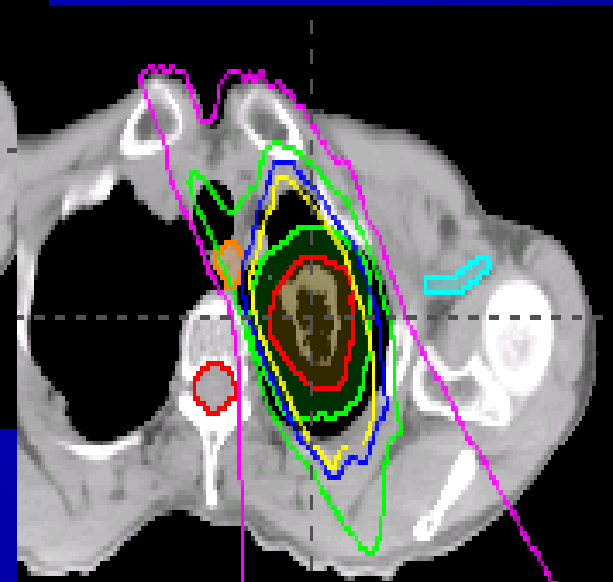
Initial plan



Initial plan
recalculated based
on CT after 5 wks
TX



Re-plan based
on CT after 5
wks TX



(Hui and Chang et al: Int J Rad Onc Biol Phy. 2008 in press)

PTV concept is different for protons

■ PTV margins

- Optimally a PTV is generated for each beam
 - Concentric PTV margins are inadequate
 - Lateral margins different than proximal and distal
- Creates problem for dose reporting
 - ICRU recommends different PTV margins for treating vs reporting

Summary

- X-ray dose uncertainties are fairly well known
 - Trials underway for dose escalation, IMRT, and IGRT
- Protons likely result in lower normal tissue dose (i.e. less toxicity)
- Tissue interfaces, tissue inhomogeneity, and target motion make dose delivery more complicated for protons
 - No satisfying local control results yet
 - Important to perform prospective clinical trials!