Commissioning a new anthropomorphic spine and lung phantom for the remote validation of treatment plans for institutions participating in RTOG 0631
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Purpose
To evaluate the accuracy of planning and delivery of radiation therapy for spinal metastases, a new spine/lung phantom was developed by the Radiological Physics Center (RPC). This phantom will be utilized to credential institutions participating in a new Radiation Therapy Oncology Group protocol (RTOG 0631). This protocol will investigate the efficacy of dose escalation in the radiosurgery of spinal metastases.

Materials & Methods
Three different treatment plans were designed in Philips Pinnacle 7.6 and administered to the spine/lung phantom: a 4-field box, a seven posterior beam conformal plan, and a seven posterior beam IMRT plan. 8 Gy was prescribed to 95% of the tumor volume in each administration. The following images show the relative dose distributions in each treatment plan; the dark blue contour is the 8 Gy prescription line.

Results
After each irradiation, the exposed films were registered to the spine/lung phantom to evaluate the accuracy of planning and delivery of radiation therapy for spinal metastases. The exposure films were scanned and a Binary Agreement Map (BAM) generated for each trial. The following images show the BAM’s created for each trial:

Conformal % Passing n
Axial 99.25 1
Sagittal 95.44 2

Four-field box. Axial and Sagittal fields, Trials 1, 2, and 3

Conformal % Passing n
Axial 98.83 3
Sagittal 95.15 3

Seven beam Conformal: Axial and Sagittal fields, Trials 1 and 2

IMRT % Passing n
Axial 88.925 5
Sagittal 91.182 3

Seven beam IMRT: Axial and Sagittal fields, Trials 1, 2, and 3

For each treatment administration, it was necessary to localize the physical isocenter to the radiation field isocenter with a high degree of accuracy. This was accomplished using marked gafchromic film that bisected the physical isocenter. Small shifts were made until the physical isocenter was in the middle of a 1 mm planar field. The following image shows the film utilized to accomplish this localization:

Conclusion
The planned and measured dose distributions for the relatively simple beam geometries of the 4-field box and seven beam conformal plans were found to be acceptable at the 5%/3mm gamma index, as greater than 95% of each binary agreement map was passing. The IMRT administration did not meet this minimum requirement. However, this may be due to the use of too many small segments in the IMRT plan. If the prescription requirements set out in RTOG 0631 can be met with a more uniform IMRT plan, this phantom will likely measure an administration to an acceptable level.

Materials & Methods

References
2. Ryu et al., RTOG protocol 0631 (preliminary draft, not publicly available).

The investigation was supported by PHS grants CA10953 and CA81647 awarded by the NCI, DHHS.