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.

The spine/lung phantom was constructed to simulate the anatomy and inhomogeneities in the critical areas for spinal radiation therapy. These tissues include lung, bone, soft tissue, and vessels. The close proximity of these structures of varying density poses a challenge to the accurate calculation of dose by the treatment planning system. Potential discrepancies between the planned dose and measured dose will be found by comparing thermoluminescent dosimeter (TLD) and gafchromic film measurements against the planned dose in the treatment planning system. The direct measurements with film and TLD should agree with 95% of the planned dose at a gamma index of 3%.

Materials & Methods

Three different treatment plans were designed in Philips Pinnacle 7.6 and administered to the spine/lung phantom: a four-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 planned dose distribution with pin-prick locations. The following images show the relative dose distributions in each treatment plan; the dark blue contour is the 8 Gy prescription line.

### Purpose

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- The new spine/lung phantom was developed by the RPC.
- This phantom will be utilized to credential institutions participating in RTOG 0631.

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- The following images show the relative dose distributions in each treatment plan.
- The dark blue contour represents the 8 Gy prescription line.

### 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.

### References

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

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