

Issues in image-guided radiotherapy (IGRT) and re-planning with megavoltage cone beam CT (MVCT)

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Purpose: In this study, the MVCT dose and its distributions are determined with ion chamber and film measurements in phantom. The effect of the imaging dose for a number of disease sites is investigated. The application of MVCT in re-planning is also addressed.

Method and Materials: A solid water phantom is CT scanned and the arc rotation of MVCT is simulated in the Pinnacle planning system. A 0.6cc ion chamber is used to measure the MVCT dose at the center of the phantom. Dose distributions are determined with Kodak XV films and compared with calculation. To investigate the effect of imaging dose, DVHs for the target and critical organs are compared with and without correcting for the MVCT dose for four diseases sites (lung, H&N, mediastinum and prostate). To assess the potential application of MVCT in re-planning, dose distributions on the planning CT of a Rando phantom are compared with those calculated on the MVCT image set. Image fusion is also performed between the CT study and its MVCT image set.

Results: MVCT dose varies linearly with MU. The imaging dose cannot be completely corrected for in practice. For example in an H&N case, the dose/fraction may be adjusted to account for the MVCT dose. 3-5% additional doses to the left eye and the left parotid are still resulted. In IGRT and re-planning applications, distributions calculated on both the planning CT and the MVCT agree to within 1%. However, erroneous contours occur on the MVCT image set because of the difference in slice thickness between the two studies.

Conclusion: While the imaging dose can be determined easily for MVCT, it cannot be corrected completely in treatment planning. For re-planning application, the MVCT slice thickness should be the same as the planning CT.

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