AbstractID: 1598 Title: Target Volume Dose Considerations in Proton Beam Treatment Planning for Lung Tumors

Treatment planning for lung cancer patients generally uses the PTV concept. For photons, PTV coverage to a certain isodose level (i.e. 95%) will ensure target volume coverage at that isodose level, because the dose distribution is almost insensitive to changes in density due to setup errors or breathing motion.

Proton dose distributions, in contrast, are severely affected by density changes as protons can range out prematurely without adequately covering the target volume. Our phantom simulations, of a tumor located centrally in lung, show that a 70 Gy proton treatment plan (conformal to the PTV) results in an equivalent uniform dose of the target volume of less then 55 Gy (i.e. a reduction with more than 20%) when taking into account representative tumor motion and setup errors. The minimum dose was 60% of the prescribed dose.

By applying additional smearing to the compensator *after* conforming an isodose level to the PTV (by as much as the margin from CTV to PTV), target coverage was assured. The minimum dose was 95% of the prescribed dose even for a 10 mm systematic setup error, i.e. when the target volume 'touched' the PTV.

On the planning CT-scan the additional smearing, necessary to ensure target coverage, translates into deliberate 'overshoot' near the field edges and more dose to normal tissues distal to the target volume. By combining extra smeared compensators and 'conformal' compensators, dose to normal tissues can be minimized while still covering the target volume.

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