Improving radiotherapy treatment for left-sided breast cancer

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Table 2-1. The maximum absolute differences (DIFF) and root mean square (RMS) deviations between the invariant (invar) and interpolated (interp) dose-volume histograms compared to the calculated dose-volume histograms for different displacement errors (DISP). Two types of dose-volume histograms are shown: the differential dose-volume histograms (dDVHs), and the integral dose-volume histograms (iDVHs). All values are given in percent of relative dose (% DOSE) or relative volume (% VOL), depending on the histogram. The differences converge to zero at δ=0 cm for all histograms. Under the interp columns, zeros are found at the displacement errors corresponding to the reference input dDVH used for the interpolation (at δ=±3.6, ±1.5, ±0.6, and 0 cm).

Table 3-1. Cost function parameters used in treatment planning and optimization. (EXT=external contour, IMC=internal mammary chain, VOI=volume of interest).

Table 3-2. Summary statistics for the volumes of interest. Numbers in the table are sample averages (%) with standard deviations (±). The p-values for the pair-wise comparisons are given in the last three columns. (BODY=partial body, dDVH=differential DVH, IMC=internal mammary chain, NA=not applicable, NTCP=normal tissue complication probability, V=versus, OBL=oblique electron technique, IMRT=IMRT tangent technique, WIDE=wide split tangent technique, SD=standard deviation, VDXX%=DVH volume point at X% dose, VD95%-107% = VD95% minus VD107%, VOI=volume of interest).

Table 4-1. Objective function used in the inverse planning process. The relative penalties are given in brackets. The priority determines to which volume voxels will be assigned in case different volumes overlap.

Table 4-2. Mean PTV coverage and heart and lung complication probabilities for the IMRT, conformal and rectangular irradiation techniques. (SD=standard deviation, VD95% - VD107% = part of the PTV that receives a dose higher than 95% and less than 107% of the prescribed dose).

Table 5-1. Relative collision and criticality scores for different overlap and critical structures. Higher scores represent more significant structural overlap and/or more important critical structures. Arbitrary clinical judgement is applied in this study for the proof of concept.

Table 6-1. Objective cost function parameters used in treatment planning and optimization. Dose-volume point constraints are quadratic penalties. The constraints are listed with their associated end-point of interest. (EOI=end-point of interest, max=overdosing costlet, min=underdosing costlet, NA=not applicable, VOI=volume of interest).

Table 6-2. Summary of the mean, maximum and minimum objective cost values (in arbitrary units) following segment weight optimization for the different treatment techniques (3DCRT vs. IMRT). Also listed are the beams’ gantry directions, hinge angles and time required for the optimization. The first number is the average over all patients and the second number (following the ‘±’ symbol) represents 1 standard deviation. The maximum and minimum objective cost values correspond to the worst and best beam orientations.
Table 7-1. The objective cost function and the dose-volume costlets used for the optimization in PINNACLE's Inverse Planning module. The volumes of interest (VOI) used are the planning target volume (PTV), the heart (HRT) and the external contour (EXT). The latter is used as a general constraint to minimize the integral dose. Also shown are the end-points of interest (EOI).

Table 7-2. Summary of the parameters comparing all plans: CN-C=conformal plan with clinical beam orientations, dDVH=differential dose volume histogram, FI-C=full intensity modulated plan with clinical beam orientations, FI-O=full intensity modulated plan with optimal beam orientations, HRT=heart, L LUNG=left lungs, NTCP=normal tissue complication probability, PTV=planning target volume, SD=standard deviation, SI-C=simplified intensity modulated plan with clinical beam orientations, SI-O=simplified intensity modulated plan with optimal beam orientations, TCP=tumour control probability, V_Dx%=relative volume enclosed by the x% isodose surface, V_Dxy%=relative volume enclosed between the x% and y% isodose surfaces, VOI=volume of interest.