AbstractID: 1196 Title: Impact of intra-fractional organ motion on tumor control probability in IMRT for lung cancer

Respiratory motion induced dose errors to the target in IMRT can be up to 48% in individual field, and up to 18 % in a single fraction with multiple fields (Duan 2002, 2003, Bortfeld 2002, Jiang 2003, Hugo 2003). Although dose errors are minimized after several fractions, the radiobiological effect of such fraction size variation is unclear. We performed tumor control probability (TCP) calculation to assess the impact of fraction size variation. An inhomogeneous tumor model (Niemierko 1993) was modified to include tumor proliferation and fraction size variation. Patient DVH and published parameters (TCD_{50}, γ_{50}, λ, T_{pot}, α/β, etc) were used in the computation assuming 30 fractions of 2 Gy with maximum variation of 18%. DVHs with 5-mm dose grid were obtained from patient IMRT plans that were calculated using patient free-breathing as well as gated CT. Without considering fraction size variation, TCP for free-breathing CT/IMRT could be 2% lower due to slightly poorer DVH resulting from tighter dose constrains due to motion margins. The impact of daily fraction size variation on TCP is fairly small due to effect of averaging over many voxels in target as well as 30 fractions. Using typical DVH from free-breathing, the TCP differences between varied and fixed fraction size ranged –1.0% to +0.7% for a constant T_{pot} of 15-100 days or accelerated proliferation. However, DVHs of normal lung using free-breathing CT/IMRT were significantly poorer compared to gated CT/IMRT due to the required motion margins and enlarged GTV.