AbstractID: 1139 Title: Image guided therapy: aiming at clonogenic cells or hypoxic cells?

This work investigates the variation of tumor control probability (TCP) with tumor cell density (C) and oxygen conditions for prostate IMRT. Twenty prostate cases treated according to different clinical protocols were analyzed. A linear-quadratic model for TCP was extended to take into account target dose and inter-patient variations. Our results show that assuming $C = 5x10^8$, $\alpha = 0.26$ and $\beta = 0.031$ under oxic conditions, TCP changed by about 7% between $D_p = 74$ and 78 Gy (assuming $\sigma_\alpha = 0.06$). There was a 5% variation in TCP among the patients receiving the same D_p due to target dose variation. Assuming $C = 10^7/cm^3$ in a 10cc sub-volume at different locations within the PTV TCP varied by 5%. Similar variations were observed under hypoxic conditions (assuming an OER of 1.7) although D_p would have to be increased by up to 40-70 Gy to achieve the same TCP as that with our current prescriptions under oxic conditions. It is concluded that small target dose heterogeneity would not affect TCP significantly under oxic conditions, independent of the location of the sub-volumes of clonogenic cells. Differential dose distributions aiming at sub-volumes of oxic clonogenic cells may only bring small improvement in outcome. Local control would be severely compromised for the same D_p under hypoxic conditions despite the size and location of the sub-volumes of hypoxic cells. Therefore, it may be more important to detect sub-volumes of hypoxic cells and target this sub-patient population with different strategies to improve local control.