AbstractID: 7723 Title: Comparing the expected effectiveness of helical tomotherapy and MLC-based IMRT using biological measures

Purpose: Presently, the radiobiological parameters of the different tumours and normal tissues are typically not taken into account during dose prescription and optimization of a treatment plan. In this study, to investigate a more comprehensive treatment plan evaluation, the biologically effective uniform dose ($\bar{\bar{D}}$) is applied together with the complication-free tumour control probability (P_+).
Material and Methods: Three different cancer types at different anatomical sites were investigated: head & neck, lung and prostate cancers. For each cancer type, a linac MLC-based step-and-shoot IMRT plan and a Helical Tomotherapy plan were developed. By using $\bar{\bar{D}}$ as the common prescription point of the treatment plans and plotting the tissue response probabilities vs. $\bar{\bar{D}}$ for a range of prescription doses, a number of plan trials can be compared based on radiobiological measures.
Results: The applied plan evaluation method shows that in the head & neck cancer case the HT treatment gives better results than the MLC-based IMRT (P_+ of 62.2% and 46.0%, $\bar{\bar{D}}$ to the internal target volume (ITV) of 72.3Gy and 70.7Gy, respectively). In the lung cancer and prostate cancer cases, the MLC-based IMRT plans are better. For the lung cancer case, the HT and MLC-based IMRT plans give a P_+ of 66.9% and 72.9%, $\bar{\bar{D}}$ to the ITV of 64.0Gy and 66.9Gy, respectively. Similarly, for the prostate cancer case, the two radiation modalities give a P_+ of 68.7% and 72.2%, $\bar{\bar{D}}$ to the ITV of 86.0Gy and 85.9Gy, respectively.
Discussion and Conclusions: Both MLC based-IMRT and HT can encompass the often large ITV required while they minimize the volume of the organs at risk receiving high dose. There may exist clinical cases, which may look dosimetrically similar but in radiobiological terms may be quite different. In such situations, traditional dose based evaluation tools can be complemented by the use of $P_+ - \bar{\bar{D}}$ diagrams to compare treatment plans.