

AbstractID: 8489 Title: Radiobiological effectiveness of 3D-Conformal Radiotherapy, MLC-based IMRT and Helical Tomotherapy in lung cancer

Purpose: To investigate the clinical efficacy and effectiveness of 3D-Conformal radiotherapy, Intensity Modulated Radiotherapy (IMRT) using Multileaf Collimators (MLC) and Helical Tomotherapy (HT), by evaluating dosimetric and radiobiological measures of a lung cancer case.

Materials and Methods: A typical case of lung cancer has been investigated by developing a 3D-Conformal treatment plan, a linac MLC-based step-and-shoot IMRT plan and a Helical Tomotherapy plan. The treatment plans of the 3D-Conformal and the MLC-based IMRT were developed on the Philips treatment planning station using the Pinnacle 7.6 software release while the dedicated Tomotherapy treatment planning station was used for the HT plan. With the use of the complication-free tumor control probability, P_+ and the biologically effective uniform dose, \bar{D} concept as the common prescription point of the plans, the three different treatment plans were compared based on radiobiological measures.

Results: The applied plan evaluation method shows that in this lung cancer case the MLC-based IMRT and the HT treatment plans are almost equivalent over the clinically useful dose prescription range, whereas the 3D-Conformal plan appears to be quite inferior than the other two modalities. More specifically, the 3D-Conformal, MLC-based IMRT and HT treatment plans give a P_+ of 55.4%, 72.9% and 66.9%, for a \bar{D} to the target volume of 57.0Gy, 66.9Gy and 64.0Gy, respectively. If a higher than 5% risk for complications could be allowed, the complication-free tumor control could be increased by almost 5% compared to the initial dose prescription.

Conclusions: In comparison to 3D-Conformal radiotherapy, both the MLC based-IMRT and HT can better encompass the often large ITV while minimizing the volume of the OARs receiving high dose. The use of $P - \bar{D}$ diagrams can compliment the traditional tools of evaluation such as DVHs, in order to compare and effectively evaluate different treatment plans.