

AbstractID: 2527 Title: Radiation induced cancer after radiotherapy: The impact of IMRT and proton radiotherapy

Purpose: There is concern about the increase of radiation induced malignancies with the application of modern radiotherapy treatment techniques such as IMRT and proton radiotherapy. In this work we analyze not only x-ray scatter and neutron radiation, but also the impact of the primary dose distribution on secondary cancer incidence.

Method and Materials: The organ equivalent dose (OED) concept with a linear-exponential dose-response curve was applied to 3D dose distributions of 30 patients who received radiotherapy treatment of prostate cancer. From the 30 patients 11 received 3D conformal radiotherapy, 11 IMRT with 6MV photons and 8 spot scanned proton radiotherapy. The IMRT treatment plans were re-calculated with 15 MV photons. For 18 MV photons the OED was approximately calculated. From the OED of the different treatment techniques secondary cancer risk was estimated.

Results: IMRT prostate treatments using low energies result in a modest increase of around 15% of radiation induced cancer compared to conventional four field planning with 15 MV photons. Using energies larger than 10 MV for IMRT could increase the probability to develop a secondary cancer by more than 20% (15MV) and 60% (18MV). The use spot scanned protons for treatment can reduce the secondary cancer incidence significantly by about 50%.

Conclusion: By including the primary dose distribution into the analysis of radiation induced cancer incidence the resulting increase in risk for secondary cancer using modern treatment techniques such as IMRT is not as dramatic as expected from earlier studies. By using an energy of 6 MV only a moderate risk increase can be expected. Spot scanned protons are the treatment of choice in regard to secondary cancer incidence.