

10-MV SBRT FFF irradiation technique is associated to the lowest peripheral dose the outcome of 142 treatment plans for the 10 most common tumour locations

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Abstract

There is a growing interest in the combined use of Stereotactic Body Radiation Therapy (SBRT) with Flattening Filter Free (FFF) due to the high local control rates and reduced treatment times, compared to conventionally fractionated treatments. It has been suggested that they may also provide a better radiation protection to radiotherapy patients as a consequence of the expected decrease in peripheral doses. This work aims to determine this reduction in unattended out-of-field regions, where no CT information is available but an important percentage of second primary cancers occur. For that purpose, ten different cases suitable for SBRT were chosen. Thus, 142 different treatment plans including SBRT, as well as 3D-CRT, IMRT and VMAT (with standard fractionation) in low and high energies for Varian (FF and FFF), Siemens and Elekta machines were created. Then, photon and neutron peripheral dose in 14 organs were assessed and compared using two analytical models. For the prostate case, uncomplicated and cancer free control probability estimation was also carried out. As a general behavior, SBRT plans led to the lowest peripheral doses followed by 3D-CRT, VMAT and IMRT, in this order. Unflattened beams proved to be the most effective in reducing peripheral doses, especially for 10 MV. The obtained results suggest that FFF beams for SBRT with 10 MV represent the best compromise between dose delivery efficiency and peripheral dose reduction..