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The accuracy of out-of-field dose calculations of a commercial model based algorithm in sliding window inaccuracy for modern technique of patients with prostate cancer

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Introduction & Objective: The out-of-filed dose can be clinically important as it related to normal tissue irradiation as the aim of the radiation therapy is decrease Normal Tissue Complications (NTCP) while increasing Tumor Control Probability (TCP). Actually radiotherapy treatment planning systems are not commissioned for the out-of-field dose calculations, although the estimation of dose distributions accuracy by TPSs beyond the borders of treatment fields receives less attention. Today's using modern radiotherapy techniques such as IMRT because of many advantages is most common, while the increase time delivery and also higher number of Monitor Units (MU), results to increase dose outside the fields which can lead to increases potentially risk of secondary cancers after treatment. Based on documents, increase in collimator scatter and head leakage has been estimated to increase carcinogenic risk. Little work has been done to quantify this out-of-filed dose calculation Inaccuracy for Modern Technique (IMRT) and any type of TPSs. The objective of this study is evaluation of uncertainties of out-of-field dose calculation using model based dose calculation algorithm, Anisotropic Analytical Algorithm (AAA), through the comparison of phantom measurements.

Method: In this study, experimental measurements were performed by Delta+4 phantoms for evaluation of IMRT technique. The calculations of the eclipse (AAA algorithm) treatment planning system in the dose values were compared with the measurement values by the Delta4+ phantom in 9 field sliding window IMRT technique for 10 patients with prostate cancer. The dose outside the field was calculated in absolute organ dose value and dose distribution as dose volume histogram values in all plans.

Result: According to the results of this study, the underestimation in average was demonstrated 38.80% in eclipse (AAA) TPS. The average error was Significant (P value<0.05). The clinical impact resulting from the error on the calculated doses were analyzed by using dose volume histogram. In cases of IMRT plans the AAA algorithm significantly underestimated the out-of-field dose (P-value<0.05). The average percentages of dose deviation in 10 plans for femoral head were 95.7 while for the organ closer to the target (rectum) were found 79.81.

Conclusion: In conclusion based on these results the calculations of dose contributions by the TPSs were poor in out-of-field area. In IMRT technique the underestimated of the dose calculations by AAA algorithm in the organs outside the field was proved, while the magnitude of the underestimation were different and was more in the organs far from the field edge. The underestimations of the Eclipse TPS were increase with increase the distance from field edge and also were significantly depended on the distance of the organ from field edge.

Biography

Fahimeh Faghihi Moghadam has completed her Master of Science degree from Shahid Beheshti University of Medical Sciences, Iran. She is currently working as a Director of Whole Body Hyperthermia at Shohadaye Tajrish Hospital. She has published more than 22 papers in reputed journals and has been serving as a Member of European Society of Hyperthermic Oncology at European Society of Hyperthermic Oncology, Germany and also Member of Iranian Association of Medical Physicists.

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