Radiobiological parameters for the dose calculation algorithms in radiation therapy

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Short Communication

Dose calculation algorithm is considered as an integral component in the treatment planning system in radiation therapy. The accuracy of dose calculation algorithm is particularly important in order to obtain the accurate estimation of the dose to the tumor. In clinical practice and majority of the clinical protocols, results are often reported in dose-volume parameters. In the recent years, clinicians have shown interest in evaluating the cancer treatment plans using radiobiological parameters. This would allow the clinicians to predict tumor control probability (TCP) and normal tissue complication probability (NTCP). The use of the TCP and NTCP values could help in predicting patient treatment outcome information. However, it is possible that the radiobiological results of one dose calculation algorithm could be different from another dose calculation algorithm even though treatment planning was done on the same patient computed tomography (CT) data.

One of the reasons that could cause the difference in the radiobiological results of different algorithms is radiation beam modeling involving the interaction of the beam with the matter. Commercial vendors in radiation therapy have different approaches for beam modeling process, and hence, clinicians often validate the new dose calculation algorithm before its clinical use. Since current radiobiological parameters are mostly based on older generation convolution superposition dose calculation algorithms, it raises the question: is it necessary to obtain new radiobiological parameters for advanced dose calculation algorithms? Many groups have quantified the dosimetric differences between the convolution/superposition and Monte Carlo based algorithms. Hence, is it appropriate to use the same radiobiological parameters for dose calculation algorithms of different generation? Current literature does not show specific radiobiological parameters for advanced dose calculation algorithms such as Acuros XB, and this needs to be addressed in the literature.

References