Dose calculations in lung treatment plans

Sir,

Recently, I read a review article "volumetric intensity modulated arc therapy in lung cancer: Current literature review"[1] published in Clinical Cancer Investigation Journal. The article does an excellent job on summarizing the latest techniques for the lung cancer treatment in the field of radiation therapy. The review article mentions that treatment planning results from different studies may not have common agreement; however, volumetric modulated arc therapy (VMAT) has a shorter treatment delivery time than the intensity modulated radiation therapy (IMRT). Shorter treatment time with the VMAT will make it more patient friendly when compared to the treatment with the IMRT.

The majority of the studies summarized in the review article[1] included the treatment plans computed by the convolution/superposition algorithms. Since lung treatment plan typically involves the low-density tissue, it is necessary to have accurate dose calculation algorithms, which will take into tissue heterogeneity corrections. However, due to the limitation in the beam modeling, it has been reported that convolution/superposition algorithms could produce errors when there is an involvement of low-density medium in the beam path.[2-4] If the tissue heterogeneity is not accounted properly, then there is a possibility of delivering either more dose to the normal tissues or less dose to the tumor. Such conditions could lead to undesired patient treatment outcome, and that would defeat the purpose of radiation therapy for cancer.

An ideal dose calculation algorithm for the lung plans would be Monte Carlo (MC); however, due to their long computing time, it is not feasible to use the MC for the dose calculations on a daily basis in the clinic. With an aim of improving the accuracy of dose calculations along with the faster computing power, a new algorithm called Acuros XB, which is based on MC approach, has been made commercially available in radiation therapy.[3,4] Researchers have found that Acuros XB is more appropriate for dose calculations that other convolution/superposition algorithms such as analytical anisotropic algorithm, collapsed cone convolution superposition, and pencil beam convolution.[3,4] Since more advanced dose calculation algorithm like Acuros XB is now available, one should try to limit the use of inaccurate dose calculation algorithms for the dose calculations in the lung treatment plans in order to ensure the patient safety and improve the accuracy of radiation therapy. In addition to optimizing the plans using dose-volume parameters, one should also try to include the radiobiological modeling in the treatment optimization,[5] which could provide information on the tumor control probability and normal tissue complication probability.

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