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Analysis of normal tissue complication probability based radiobiological models: a systematic review of literatures

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Abstract

To achieve the optimal treatment goal, radiobiological parameters has to evaluate and predict the outcome of this treatment plan in terms of both Tumor control probability and Normal Tissue Complication Probability. Different types of radiobiological model were used to achieve prescribed treatment dose of radiation during the tumor control. TCP models play an important role in order to achieve desired dose to the tumor. A suitable NTCP model was theoretically found among different models that can be used in treatment plan evaluation.

Theoretically, six different radiobiological dose response models such as Lyman–Kutcher–Burman, Critical element, critical volume, Relative Sterility, Parallel architecture, Weibull distribution were analyzed in this project. All models were discussed elaborately with its various parameters and were used in the calculation of normal tissue complication probability during the treatment in radiotherapy. Further, all models were compared with each other. The models denote the dose for 50% complication probability (D50) parameters is the most commonly used radiobiological models for the normal tissues. The functional subunit response models (critical element & Relative sterility, Critical Volume, parallel architecture) are used in the derivation of the formulae for the normal tissue.

Since all complicated NTCP model predict same as the simple NTCP model that is Lyman– Kutcher–Burman model as well as it is computationally efficient. Also Lyman–Kutcher– Burman model can be used in different treatment planning system incorporating with other model. For this reason our suggested model is Lyman–Kutcher–Burman NTCP model which can be used in treatment plan evaluation.

Conclusion

After analyzing six different model of NTCP, finding of the study is the treatment plan evaluation in where Lyman–Kutcher–Burman model may be considered as a better option for biological plan evaluation.

Biography

Md. Asadur Rahman is currently working as a faculty member in the Biomedical Engineering Department at Military Institute of Science and Technology (MIST), Mirpur Cantonment, Dhaka, Bangladesh. His research interest includes biomedical signal processing, brain-computer interface, functional brain imaging, and algorithms development. In addition, he has a wide interest in machine learning algorithms. Furthermore, he completed his BSc. and MSc. Engineering in Electrical and Electronic Engineering.

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