

Reinterpreting Biological Equivalent Uniform Dose for LATTICE Radiotherapy

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Abstract
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Abstract

Objectives:

Lattice Radiotherapy (LRT) enhances tumor response without increasing patient's toxicity by creating a very heterogeneous, peak to valley dose distribution inside voluminous tumors. LRT has been demonstrated to be safe and effective. However, so far, there has been no effective analysis to correlate between the Equivalent Uniform Dose (EUD) of LRT and the observed results of tumor control. The aim of this study is to find this correlation, specifically for the use of LRT in the treatment of advanced, bulky uterine cervical cancer.

Methods:

The analysis will be based on the Tumor Control Probability (TCP) obtained from a group of 20 patients with locally advanced cervical cancer (LACC) treated with LRT. The generalized EUD formulism, using a single parameter 'a', proposed by Niemerko, was used to calculate the values of EUD vs 'a' from the Dose Volume Histogram for each of the analyzed patients. A correlation between the TCP and the EUD values will be used to find a useful value of the parameter 'a' that better describe the effect of the heterogeneous dose distribution deliver using LATTICE in the case of LACC.

Results:

A new and positive coefficient 'a' value in the EUD formulism, ranging between 2 and 8 (average 5.5), has been identified as more appropriately describing the biological effects observed in this series of patients.

Conclusion(s):

These results suggest that the traditional EUD needs re-interpretation in order to better correlate the technique with the clinical outcomes. Practically, the coefficient 'a' in the EUD as formulated by Niemerko would need to assume a different value to reflect the unique biological response of LRT. This value, very different from the traditional value of -10 that is used to project the tumor control when inhomogeneous doses are encountered in conventional radiotherapy, is more consistent with the hypothesized, unconventional, and advantageous biological effects when SFRT is used.