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The effectiveness of non-uniform dose fractionation compared with the uniform dose fractionation radiotherapy for malignant tumors of various types of cancer cells

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Optimization of radiation therapy treatment scheme using mathematical modeling is one of the topical problems in modern radiation oncology. For these purposes, formalized description of dynamic processes in clinical radiobiology is used. This study examines the effectiveness of the non-uniform dose fractionation mode as compared with a uniform dose fractionation in the treatment of tumors with different cell types. Using mathematical models of tumor cells survivals, various scenarios of dose fractionation were examined. In our calculations, we used following delivery of uniform dose fractions (2 Gy/day) and non-uniform dose fractions (increasing fraction size up to 5 Gy/day). In both cases, the total dose D is 50 Gy, the treatment period T is five weeks. In our results, we have shown that when tumor has large volume of oxygenated cells the non-uniform fractionation has more efficiency compared with the uniform fractionation. In addition, the radioresistance of hypoxic cells has almost no impact on this efficiency. For tumors which has small fraction of oxygenated cells, the efficiency of non-uniform fractionation markedly decreases with increasing radioresistance of hypoxic cells. So, modern methods of mathematical and computer modeling in clinical radiobiology are effective tools for optimization of radiation therapy.

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Comparison of conventional vs. software-based methods for rapid arc SRS QA

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Aim of this study is to evaluate a SRS rapid arc QA method using the portal dosemeter as a viable QA tool and comparison of its results to the conventional physic's QA methods, the film and ion chamber measurements. Both absolute and relative QAs' results have been studied in this study. Ion chambers have a high dependancy on their setup and more specifically on their placement within the radiation field. Large variations in their readings can stem from a minute setup deviation. This is especially accentuated in the case of a the high dose gradient areas of a small field SRS field. The results are very dependant on this placment accuracy. On the other hand, the outcome is limited to one absolute measurement data per placement. The same can be said about film dosimetry and its own uncertainties such as developer conditions, film batch and the film development procedure as a whole. Similar to the ion chamber setup, one can expect one relative measurement data out of each film setup. We are presenting a portal dosimetry based QA tool that will not have similar uncertainties but on the other hand, produces range of measurment data per exposue, based on acctual delivery plan not hypothetical results. We are comparing its performance to the conventional methods of the ion chamber and film based measurements.

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