AbstractID: 10841 Title: Development of software for performing radiobiological studies and treatment plan optimization

Purpose

The aim of this study is to present developed tools that are necessary to determine and verify dose-response parameters of tumors and healthy tissues. Furthermore, this software uses this radiobiological information in order to compare and optimize several treatment plans.

Material and Methods

One part of the software determines the dose-response parameters for tumors and healthy tissues. The dose distributions of each patient are associated with their follow-up results in a maximum likelihood fitting, which calculates the best estimates and confidence intervals of the model parameters. Another part is used to validate reported dose-response parameters. The software uses local dosimetric and treatment outcome data and associates them with published radiobiological parameters using various statistical methods (χ^2-test, ROC, odds ratio etc). The third part is used to estimate and increase the likelihood of complication-free tumor control, P_+ by plotting the response curves of the control, complication and P_+ probabilities using the mean dose to the target on the dose axis.

Results

Head & neck and prostate cancer cases are used to show the clinical usefulness of this radiobiological tool in treatment plan comparison. The compatibility of the examined treatment methodologies with a set of reported dose-response parameters was confirmed using the appropriate module of the software. The prescribed dose levels were determined by renormalizing the treatment plans until the P_+ index became maximal. A more conformal dose delivery to the target shows that a higher control rate is achieved for the same complication level.

Conclusions

The described tool is proved to be useful and effective in the clinical application of radiobiological modeling. Furthermore, it can be applied in the development of clinical information databases and for performing epidemiological studies assisting the cooperation between different institutions in order to produce research and clinical frameworks.