

Purpose: To develop a software framework which allows analysis and evaluation of outcomes for patients treated with hypo-fractionated stereotactic body radiotherapy (SBRT)

Method and Materials: An outcomes-study database was designed, under IRB-approval, to collect and analyze medical information for lung cancer patients undergoing SBRT. The outcomes-study database incorporates a variety of patient information, including demographic, social, diagnostic, treatment and follow-up data. A software tool with a graphical user interface was developed to calculate biological dose indices, including TCP, EUD (Niemierko) and NTCP (Lyman-Kutcher-Burman and relative seriality models). Biologically effective doses are determined from dose distributions and DVHs, automatically imported from the treatment planning systems.

Results: Approximately 200 SBRT patients' medical records have been populated into the outcomes database. To demonstrate the functionality of the software framework, 11 lung cancer patients treated with SBRT (12 Gy/fraction x 4 fractions) for central lesions (tumors within a 2 cm zone of the proximal bronchial tree) were reviewed. The linear-quadratic (LQ) adjusted mean lung dose was 13.38 Gy (range: 9.24 Gy to 16.50 Gy) with an α/β ratio of 3.0 Gy. Observed lung toxicities were reviewed using the database and showed the regimen to be well tolerated: none of the patients developed grades 3-5 toxicities and only 2 lower-grade toxicities were noted. The calculated NTCP ranged from 1.73% to 8.22% using the LKB model, with parameters $n=1$, $m=0.33$, $TD_{50}=30.5$ Gy.

Conclusions: One of the goals of the outcomes database is to enable the investigation of correlation between dose, volume and effect for patients treated with SBRT, using non-standard, hypo-fractionated RT doses. Parameters specific to biological dose models are being updated using maximum likelihood analysis of calculated probabilities vs. observed outcomes for this large cohort of patients. Such outcomes studies are important in understanding the efficacy of new treatment paradigms.