Tumor control probability of undifferentiated nasopharyngeal cancer

Purpose
To implement and validate a model for tumor control probability (TCP) of undifferentiated nasopharyngeal carcinoma (UNPC).

Materials and Methods
We use a modified version of the Webb-Nahum model that includes corrections for repopulation and chemotherapy effect. A value for potential doubling time of 5.9 days is taken from literature. An α/β of 10 Gy and clonogen cell density of 10^6 cells/cm^3 are chosen based on radiobiology of other head and neck tumors. Values for remaining parameters are determined by considering clinical local control data from published randomized studies on radiotherapy of UNPC. Based on these studies an α of 0.365 Gy^{-1}and σ_α of 0.1 Gy^{-1}a re chosen to have a calculated TCP of 80% for a prescribed dose of 66-74Gy. A value of 1.05 is chosen for the dose enhancing factor of induction chemotherapy, to increase TCP to 85% in the same dose range.
Model is validated by calculating TCP on patients treated for UNPC at our institution with intensity modulated radiation therapy (IMRT) and induction chemotherapy, and comparing average patients TCP with local control rate.

Results
Average TCP on our patients is 81.24%. Local control was obtained in 15 over 18 patients, so that local control rate is 83.33%.

Conclusions
The good agreement between average TCP and local control rate encourages us to use this model for plan evaluation, and for studying new fractionation schemes and dosages.