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Purpose: To analyze the efficiency of SIB IMRT treatments of Head and Neck Cancers at different institutions using the radiobiological modeling in HART program.

Materials and Methods

- SIB IMRT and SIB ARC-Therapy Implemented in treatments of head and neck (H&N) cancer patients in the past 2 years.
- SIB plans for 12 oropharyngeal and nasopharyngeal cancer patients were analyzed in a retrospective study at 2 major institutions (Mayo Clinic and BP Memorial Cancer Hospital).
- Reference prescription dose for TCP/NTCP study: 70 Gy
- TCP Inputs: DVH data-points (V93, V95, V100, V105, V110, V120) and radiobiological parameters (TD50/5 =63.8 Gy, α/β =10, y50=2) respectively.
- NTCP Inputs: DVH data-points (V25, V50, V75, V100) and radiobiological parameters (TD50/5, α/β=3, n, y50; PMB, Luxton etal 2008) for bilateral parotid and larynx respectively.

Background

- Open source software system designed in MATLAB in order to process RTOG and DICOM-RT image data-file formats in Radiation Oncology *
- Unique module for the efficient and accurate conventional and space-time dose-volume histogram (DVH) analysis (cDVH and sDVH respectively),
- An automated computational and simulation functionality module simply bypass rigorous coding task for users utilizing advanced set of graphical user-interfaces (GUIs),
- Novel approach of the universal plan-indices (UPI) evaluation, and empirical radiobiological modeling and outcome analysis (EROA) modules for radiotherapy plans,
- HART based EROA features are efficient and effective modules to understand the clinical outcomes of both SIB and SIB-ARC treatments of head and neck cancer patients (N=12).

Results and Discussions

- Real-time DVH and Radiobiology Interactive Module

Fig.1 Graphical user-interface panel of the HART Program

Empirical Radiobiological Modeling Outcome Analysis:

- SIB IMRT treatment Methods for Head and Neck Cancer
- Poisson Statistics TCP module for tumor control, and
- JT Lyman NTCP module to examine toxicity in organs.

HART Program:

- Tumor Progression Free Survivability and TCP Index

The estimated TCP (0.59±0.06) was found to be in good agreement with the clinical follow ups for overall tumor progression free survivability statistics (0.69; N=13).

- Prediction of Organ Toxicity & End-Points for Parotids

Fig.2 A real-time tracking DVH analysis (Top) & radiobiological modeling for JT-Lyman NTCP outcome analysis module (Bottom).

Fig.3 A correlation plot for estimated threshold NTCPs for Grade 3+ (TD50=46 Gy, n=0.7, y50=2.2) and Grade 2+ (TD50=28.4 Gy, n=1, y50=2.2) Xerostoma in SIB-IMRT and SIB-ARC radiotherapy treatments of head and neck cancer patients (N=12).

- Correlation of Organ Toxicity & End-Points for Larynx

Estimated NTCP for larynx <1% (N=12) in consistent with the clinical follow ups for edema in SIB-IMRT & SIB-ARC treatments.

Conclusion

- HART program is a universal type of computational tool in the radiotherapy research using the RTOG and the DICOM-RT plans. It is available freely online*, and live technical support is also available to the users through the social networking site facebook.

- HART based EROA features are efficient and effective modules to understand the clinical outcomes of both SIB and SqIB (IJROBP 2012, Volume 84, Issue 3, Supplement, Pages S812-S813) treatments of head and neck cancer patients.

- Selective radiobiological models such as Poisson Statistics TCP Model and JT Lyman NTCP Model can be efficiently utilized to analyze the local control probability of tumors, organ toxicity and overall prognosis of the SIB and SqIB treatments in H&N cancer.

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References


* URL: http://HART.Research.UIC.edu/

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