A study of the radiobiological modeling of the conformal radiation therapy in cancer treatment.

Author: Anil Pyakuryal, PhD

Email: apyaku1@uic.edu

Institution: Northwestern Memorial Hospital/ University of Illinois at Chicago

Supervisors: Dr Sivalingam Sivananthan and Dr Sunyoung Jang

Graduation Date: August 5, 2012

Available Online: https://dspace-prod-lib.cc.uic.edu/handle/10027/9467

Abstract

Cancer is projected to overtake cardiovascular disease and become the top cause of death worldwide by 2012, according to the report published from the International Agency for Research on Cancer, a division of the World Health Organization (WHO). The burden of cancer is set to triple by 2030 according to that report. So, the accurate diagnosis and appropriate treatments such as surgery, chemotherapy and radiation therapy are very important in the proper cure of cancer. In this study, we explored more practical methods of the single or dual imaging modality using Positron Emission Tomography (PET) and Computed Tomography (CT) scans to detect tumors in the head and neck, left lung, left breast, and prostate cancer patients respectively. The optimal conformal radiation therapy (CRT) and intensity modulated radiation therapy (IMRT) plans were also designed in the CT and/or PET/CT images to perform the efficient treatment of these diseases at the Northwestern Memorial Hospital in Chicago. Furthermore, novel dose-volume histogram specific models such as universal plan-indices (UPIs), the spatial dose-volume histogram analysis and the radiobiological models were also utilized to assess the quality and outcomes of the CRT and IMRT treatments in the open-source software system, ***Histogram Analysis in Radiation Therapy*** **(HART)**. The retrospective study showed that CRT and IMRT treatments are the effective techniques to control the tumor by

minimizing the radiation toxicity in the neighboring normal organs in the treatment of breast and prostate cancer patients. It can also be concluded that the proper selection of the UPIs and the radiobiological models could be useful to achieve the goals in the radiation guided treatments in the complicated cases such as head and neck, and lung cancers.

References to author publications that relate specifically to the dissertation:

1. **A. Pyakuryal**, K. Myint, M. Gopalakrishnan, S. Jang, J. Logemann and B. Mittal, "A computational tool for the efficient analysis of the dose volume histograms from radiotherapy treatment plans," *Journal of Applied and Clinical Medical Physics*, Vol. 11, No. 1, *Article no.* 3013, p.137-157 (2010).

2. **A. Pyakuryal**, "Implications of Histogram Analysis in Radiation Therapy Software, "Student paper accepted for publication in the *Proceedings of 11th World Congress for Medical Physics and Biomedical Engineering*, *IFMBE proceedings 25/I*, p. 5-8 (2010).