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Bogusław Maciejewski

M Skłodowska Curie Memorial Institute, Poland

Volumetric, molecular and image guidance for radiotherapy of cancer

Aim of Study: To evaluate impact and significance of initial tumor volume (ITV) vs. TNM staging on radiotherapy outcome (3 yrs. LRC) and application of molecular and radiological images for personalized optimization of radiotherapy (RT).

Materials & Methods: Over 600 skin cancer, and about 1000 H&N cancer cases were used to analyze correlation between ITV vs. TNM and 3 years locoregional control, including data taken from the literature. Predictive value of postop molecular margins for optimal RT, and results of the trial on conventional vs. accelerated postop RT was analyzed regarding clinical and molecular predictors. Application of high-tech 3D CT and f MRI 3T images for navigated neurosurgery and postop RT was presented together with original "Image Guided Radioneurosurgery System for Brain Tumors" in the Institute of Oncology in Gliwice.

Results: According to clinical radiobiology, target for the RT is ITV reflecting initial number of tumor clonogens (K) but not the T and N stage. The results show significant decrease 3 yr. LRC of H&N cancers even within the range of a given T stage. For example, ITV of laryngeal tumors in T2 stage differ by at least one decade of K whereas for these T2 tumors the same total dose was planned and delivered. The results of the trial with H&N cases showed no difference between conventional and accelerated RT. However when own molecular scoring system has been defined and used, specific molecular signature selected subgroup of cases with much higher 3 yr. LRC after accelerated RT. Own system of fusion of the 3D CT-fMRI images has been developed to improve neuronavigated neurosurgery of malignant brain tumors and to plan simultaneously postop RT-IMRT (Intensity Modulated Radiotherapy). Although local control and survival of glioblastoma multiforme patients did not improve, the rate of very serious postop complications decreased by 50%.

Conclusions: In radiotherapy, traditionally used TNM to plan total dose and fractionation should be implemented by tumor-nodal volume parameters, reflecting initial number of tumor clonogens which are, in fact the major cell-kill target. Fusion images of 3D CT and diffuse and functional MRI f 3T are precise and useful guidance to optimize personalized therapy for cancer patients.

Biography

Bogusław Maciejewski has completed his PhD and got scientific title of a Full Professor in Radiotherapy. He released research projects in the UCLA Los Angeles, Gray Lab London, MGH Harvard University, Boston, MDACC Houston and other cancer centers in Europe. He was the Director of Cancer Center–Institute Gliwice, Poland for 24 years, till 2015. He is Author of over 200 papers published in reputed journals (IF=1650, citation index=3500). He was awarded G F Fletcher Gold Medal, Gold Medal of Life Achievements in Oncology given by all European Oncologic Societies as he is a honorary member of American College of Radiology, Radiotherapy Expert of the IAEA in Vienna, and for 10 years he was a Member of European Board of Radiotherapy, participating in the development European curriculum for radiotherapy. His major scientific interest is importance of treatment time and tumor repopulation and altered dose fractionation in clinical radiotherapy for human tumors.

bmaciejewski@io.gliwice.pl