**Streszczenie pracy doktorskiej mgr Kamili Rawojć pt.: *„Zastosowanie metod cytogenetyki i algorytmów do kalkulacji dawki w przewidywaniu efektywności radioterapii”***


**Summary**

**Introduction:**

Radiotherapy is one of the leading and dynamically developing therapeutic methods in the fight against cancer. Its main purpose is to kill cancer cells while maintaining the proper functioning of normal tissue. Progress in radiotherapy mostly consists in optimizing irradiation of the tumor area with a dose sufficient to eliminate all tumor cells with the maximum protection of healthy tissues against the occurrence of side effects.

**Aim of the study:**

The aim of the study was to assess the usefulness of cytogenetics and dose calculation algorithms in predicting radiotherapy effectiveness. Proposed research topic might be a new, interdisciplinary and holistic approach to the in further optimizing radiotherapeutic process.

**Materials and methods:**

In the study, human peripheral blood lymphocytes, representing the ex vivo cell model were used. Lymphocytes were irradiated with photon radiation and proton beam in the dose range: 0.3 - 20.0 Gy. Two cytogenetic tests were used to analyze cell radiosensitivity: the Cytokinesis-Blocked Micronucleus assay (CBMN) and the Premature Chromosome Condensation (PCC) test. Also, the compliance of results obtained with real dose measurement with doses calculated using PBC (Pencil Beam Convolution) and AAA (Analytical Anisothropic Algorythm) algorithms and Monte Carlo simulation was evaluated.

**Results and conclusion:**

CBMN test, for the photon radiation, showed the linear-quadratic trend of the cellular response in the dose range 0.3 - 4.0 Gy. A different cellular response with a non-linear trend in the low dose range (0.3 - 4.0 Gy) was obtained for the proton beam. Analysis of scoring 500 binucleated cells instead of 1000 for the CBMN test, and 150 instead of 75 for the PCC test presented statistical compliance with the possibility of evaluating radiosensitivity and shortening the time of results evaluation. Comparing two different algorithms PBC vs. AAA for the photon radiation with the values measured in structures with a high gradient of electron density showed that the use of the AAA algorithm gives convergent results for both, measured values and values obtained from the Monte Carlo simulation.

All the goals of the study with the research hypothesis discussing the possibility of creating an appropriate radiotherapeutic plan by using dose calculation algorithms 2

and cytogenetic methods was verified. Introducing an additional step before radiation therapy planning such as collecting patient's blood, *ex vivo* irradiation, examining the patient's peripheral blood lymphocytes response to the selected type of radiation and then selecting appropriate dose calculation algorithm would allow further striving to increase the effectiveness of treatment and, therefore, its better overall clinical outcome