Effect of Blood Flow for Combination of Hyperthermia with Radiation Therapy for Treatment in Breast Tumor

*Alexa Barrios[1], Oiendrila B. Debnath[1], Malvina Supper[1], Kazuyuki Saito[2], Koichi Ito[2], Mitsuru Uesaka[1]
[1] The University of Tokyo; [2] Chiba University

Abstract

Combining hyperthermia and radiation therapy is as lethal to cancer cells as high radiation dose alone. Blood flow is an important parameter for hyperthermia as blood is a temperature regulator of our body. In this research, a dynamic phantom is used to evaluate the effect of the blood flow's cooling effect to decide the optimal timing and degree of each procedure, as well as investigating the DNA double-strand breakage and repair by γH2AX.

Keywords: hyperthermia, radiation therapy, dynamic phantom, double-strand break, γH2AX

1. Introduction

Combination of hyperthermia and radiation therapy for treatment of tumor has been investigated by many researchers. The technical difficulties arise from the tumor's inability to maintain the temperature due to blood flow [1]. Blood being a temperature regulator makes it difficult to maintain higher temperature for a long time. The purpose of this research is to investigate the blood flow effect in the dynamic phantom and analyzing DNA damage due to this combination.

2. Methods

2.1 Blood flow in dynamic phantom

Previous experiments were done on static phantoms [2] and in this research experiments with a dynamic phantom with realistic blood flow effect would be done. A complex 3D tumor would be considered inside the breast dynamic phantom and blood flow effect in the normal cells and tumor cells would be observed separately.

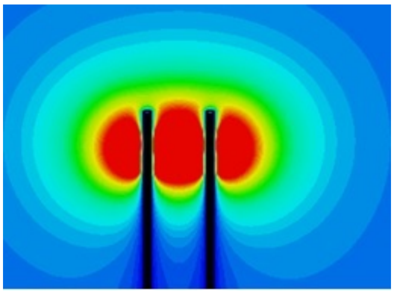

Fig. 1. Heat distribution of coaxial-slot antenna array in tumor tissue phantom.

2.2 DNA double-strand break and repair observation

The combination of hyperthermia and radiation would be observed microscopically to see cellular damage. The heat induced in the cells would affect the DNA breakage, thereafter causing more damage from application of radiation. Post hyperthermia, and combination of hyperthermia and radiation, DNA repair would be observed. The heat distribution within tumor tissue is shown in Fig. 1 [2].

3. Summary

In this experiment, we expect to see the blood flow effect on the increasing and maintaining high temperature and vice versa [1]. This would affect further to optimize the temperature dose and radiation dose. Regarding the DNA breakage and repair, we hope to understand the optimized lethal dose required for the tumor annihilation.

References

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