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Role of Nanomaterials in Enhancing Hyperthermia Effect for Brain Cancer Treatment: Computational Studies

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CHAPTER V

CONCLUSION

The technical challenge in hyperthermia treatment is to heat the tumor to the appropriate therapeutic temperature without causing damage to the surrounding healthy tissue. The results presented in this research show that conventional hyperthermia treatment can be enhanced through the use of nanoparticles.

A full segmentation for human head was implemented using 3D Slicer platform. We built RHHM based on 2D MRI gained from the same patient. These images comprise the information necessary for recognizing the five main parts of the head model.

Simulated results for enhanced hyperthermia brain cancer were obtained using CST studio and values for the SAR and transient temperature in the healthy tissue and the tumor were presented.

Results obtained from our human head simulation showed that:

1. SAR calculation at 2.45 GHz is 100 (mW/Kg), while at 915 MHz is 200 (mW/Kg).
2. SAR results in the tumor region when using GNPs is about 300 mW/kg , while when not using GNPs the SAR is 200 mW/kg.
3. Without NPs present around cancer, the temperature inside cancer is 39.2 °C, and outside cancer is 38.4 °C.
4. The temperature reaches a values greater than 43 °C at the center of cancer, when using different NPs materials, it reaches a value of 43.49 °C when using GNPs, it reaches a value of 43.32 °C when using AgNPs, and finally it reaches a

value of 43.14 °C when using GNPs, while the temperature will be around 39 °C without using NPs.

From the results of these studies we can conclude that:

1. According to SAR calculation that we have a better MWI at 915 MHz frequency.
2. We have better SAR results in the tumor region when using GNPs.
3. There is an insignificant temperature increase in the cancer to cause any damage to the cells without NPs present around cancer.
4. When using different NPs materials, the temperature of cancer reaches value significant for hyperthermia treatment (greater than 42 °C).
5. We have better temperature results in the tumor region when using GNPs.

Future Directions

An important component of future research is to apply different magnetic nanomaterials to the implemented system. Also we desire to apply same system on different organs to investigate the effect of different dielectric properties of human organs. We definitely need to do more research in investigating the side effects of nanoparticles in medical therapy.