CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
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Project Number
S0403

Project Title
New Imaging Technique Promises Higher Resolution of Brain Cancer Tumor Boundaries using Photoacoustic Imaging

Abstract

Objectives/Goals
Photoacoustic imaging is a rapidly growing imaging modality that offers higher spatial resolution and depth penetration compared to fluorescent optical imaging. However, it has its limitations when looking at tissue not treated with exogenous contrast agent. Without any external contrast agent, regular tissue and cancerous tissue show little difference in photoacoustic signal. For this reason, an imaging agent is necessary to differentiate cancerous tissues from normal ones. This study validates the use of Cy5.5 conjugated to RGD as an imaging agent for photoacoustic imaging. By targeting the avb3 integrin, a vascular target associated with tumor angiogenesis, our imaging agent should bind to the tumor cells which express avb3 on their membrane.

Methods/Materials
A phantom study was preformed to determine the validity of the contrast agent as a viable photoacoustic agent. Live Mice Experiments were later conducted on mice with xenografted U87MG brain cancer tumors that over expressed the target avb3 integrin. A subcutaneous injection experiment was preformed in which the Cy5.5 RGD signal was measured over a period of 5 hours. An intratumoral injection was preformed in which both the signal emanating from the tumor and the signal from the control were monitored at various timepoints over a period of 20 hours.

Results
The phantom experiment yielded a linear decrease in signal with a corresponding linear decrease in concentration of the imaging agent, showing that this agent is a viable photoacoustic imaging agent. The subcutaneous injection experiment showed the clearance of contrast agent from the mouse in 5 hours, indicating that the agent clears the body in the absence of its target. The final intratumoral experiment showed strong uptake of signal in the tumor, and clearance of signal in the control, further validating this imaging agent as a viable one for brain cancer tumor demarkation.

Conclusions/Discussion
The results presented herewith support that Cy5.5-RGD shows promise as a novel imaging agent for photoacoustic imaging. The pharmacokinetic properties validate it as a useful imaging agent that will bind to the target integrins and clear out of normal tissue. The signal increase can be visualized in images that may help aid surgeons in removal.

Summary Statement
This project aims at validating a novel imaging agent for brain cancer tumor demarkation using photoacoustic imaging.

Help Received
Mentor supervised my lab work and handled the mice.