Time Course Study of Blood-pool and Liver Targeting Gold Nanoparticle Contrast Agents

Christina Tan 1, Nancy Ford 2

1Faculty of Medicine, University of British Columbia, Vancouver, V5Z 1M9, Canada; chrstan@dentistry.ubc.ca 2Department of Oral Biological and Medical Sciences, Faculty of Dentistry, University of British Columbia, Vancouver, V6T 1Z3, Canada 3Department of Physics and Astronomy, Faculty of Science, University of British Columbia, Vancouver, V6T 1Z3, Canada

Introduction

Computed tomography (CT) is a common non-invasive medical imaging technique that provides 3-dimensional images of organs and tissues using contrast agents (CA). Gold nanoparticle contrast agents (AuNP CA) have gained research interest as a CT CA for their modifiable surface, long circulation time, biocompatibility, and high X-ray attenuation. MVivo Au, an AuNP CA, alone behaves as a blood pool CA but when the surface of AuNP CA is modified with a moiety it can be used to target an organ or tissue type.

Methods

A time-course experiment is used to investigate and compare the contrast enhancement and behavior of MVivo Au a blood pool agent and MVivo AuNH2 a liver targeting agent. Each contrast agent is injected into five healthy C57Bl6 mice via tail vein injection at 0.1mL per mouse following anesthesia. Mice are anesthetized using 5% isoflurane in O2 in the induction box then transferred to a nose-cone at 2% isoflurane in O2 in the GE eXplore CT 120. Each in vivo scan is obtained using the continuous rotation technique at the following time points: pre-contrast, post-contrast 0, 0.5, and 24 hours. The contrast enhancement is measured using MicroView for three groups of organs: non-enhancing regions (air and left leg muscle), vascular system organs (right ventricle and vena cava) and clearance organs (liver, kidney, spleen and bladder).

Results

The micro-CT images at the same time points for MVivo Au and MVivo AuNH2 are compared. As expected the raw data confirms the increase in contrast enhancement for both CA from pre-contrast to post-contrast 0.5 hours for both the non-enhancing and enhanced vascular system organs. In comparison, the clearance organs continued to increase in contrast enhancement from post-contrast 0.5 hours to 24 hours while the other organs displayed contrast enhancement decrease. The liver targeting MVivo AuNH2 was expected to accumulate in the liver causing a significant increase in contrast enhancement measurements but the results of MVivo AuNH2 were similar to MVivo Au.

Conclusions

These results indicate that MVivo AuNH2 did not perform as expected. Contrast enhancement in the liver for mice injected with MVivo AuNH2 were similar to mice injected with MVivo Au. But both CA travelled through the circulation slower as seen by the increased contrast enhancement in the three groups of organs up to 0.5 hours post-contrast. Overall the modification and further testing of MVivo AuNH2 is required to ensure the liver targeting CA accumulates in the liver at a significant amount.