Fluorinated Fructose Derivatives for PET Imaging

Published date: Nov. 29, 2011

Technology description

Background

Positron emission tomography (PET) is a non-invasive nuclear medicine imaging technique that produces a three-dimensional image of physiological processes and tissue microenvironments, which is used for diagnosing and/or treating diseases including cancer, heart disease, and brain abnormalities. Traditionally, tumour imaging with PET relies on the use of the glucose analogue 2-deoxy-2-[18F]fluoro-D-glucose ([18F]FDG) as the imaging agent, which takes advantage of the characteristic overexpression of GLUT1 (a member of the family of facilitative hexose transport proteins known as GLUTs) in many cancerous cells.
Unfortunately, [18F]FDG-PET is ineffective in the detection of small tumours and more differentiated subtypes, accumulates in areas of inflammation (due to the large uptake of [18F]FDG by immune cells), and therefore, generates false-positives, or poor resolution images in PET .
Additionally, certain tumours demonstrate low expression of GLUT1, and thus false-negatives may be observed due to low concentrations of [18F]FDG entering these cancerous cells.

Description

In breast cancer, the glucose/fructose transporter GLUT2 and the fructose transporter GLUT5 have been shown to be overexpressed in many breast tumours, suggesting that fructose-based analogues would be useful for the improved imaging of breast cancer.
Dr. Chris Cheeseman and colleagues at the University of Alberta have recently designed and synthesized a new class of fluorinated fructose compounds. Such fructose-based radiopharmaceuticals have the potential to be used during in vivo PET imaging of breast cancer. One such compound, 6-deoxy-6-fluoro-D-fructose (6FDF), has been shown to be transported in vitro into two human, GLUT5 expressing breast cancer cell lines. Early in vivo trials using a GLUT 5 expressing murine breast cancer model have had promising results, with flank implanted tumours readily taking up [18F]6FDF.

Advantages

Enhanced sensitivity and specificity to small tumors and more differentiated sub-types such as tubular carcinomas or lobular carcinomas, which will generate more accurate and reliable 3D images.

Improved image resolution with clear distinction of tumoral cells from surrounding inflammation, which would enable more accurate monitoring of treatment efficacy.
Interactivity allowing varying lighting conditions.
Ability to image GLUT5 expressing, [18F]FDG-PET invisible tumors.

Institution

University of Alberta