Positron-Emitting Surrogate Microspheres for Image-Based Dosimetry in Radioembolization Therapy

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Technology description

Positron-emitting surrogate microsphere for image-based dosimetry in Yttrium-90 radioembolization therapy.
This surrogate positron emission tomography (PET) technology can be used to perform accurate dosimetry with greater spatial resolution and contrast than the current method. Development of a positron emitting surrogate microsphere and the means to use it in pre-treatment dosimetry can move treatment planning for Y-90 radioembolization towards a level of accuracy that is expected in other radiation therapy techniques such as brachytherapy and external beam therapy.

Background

In the global human population, liver cancer is a major cause of death. According to the American Institute for Cancer Research, there were over 840,000 new cases in 2018. The most common type of primary liver cancer is hepatocellular carcinoma (HCC). It accounts for 70% to 90% of all primary cancers of the liver. Colorectal cancer (CRC) is a major source of metastases to the liver. Approximately 35% to 60% of patients with CRC will develop liver metastases.
Chemotherapy is a method of cancer treatment that is characterized by the use of drugs that primarily inhibit cell division. Radioembolization is a method often used when patients have unresectable liver cancer that is not responsive to chemotherapy. Radioembolization of liver tumors using yttrium-90 (Y-90) labeled microspheres is a proven method of treatment. The electrons produced during decay deliver a cytotoxic radiation dose in a localized volume. The radiation dose is sufficient to kill tumor cells yet spare the normal liver. The Y-90 microspheres are delivered via a catheter that has been placed in an artery that supplies blood to the tumor. Microspheres are injected and the blood distributes the microspheres.
The current practice involves two separate procedures. The first procedure is an assessment of the vasculature of the liver and tumor. This assessment is performed with radiolabeled macro-aggregated albumin particles (Tc-99m MAA). The Tc-99m MAA is injected via a catheter placed in the same location that will be used for the delivery of Y-90 microspheres. The distribution of the Tc-99m MAA particles is imaged using a gamma camera. This data is used to predict the microsphere distribution and subsequent dose to the tumor, normal liver, lungs and other organs. The data may be used to adjust

the Y-90 activity and to perform crude pretreatment dosimetry; unfortunately, accurate pre-treatment dosimetry is largely absent. There exists a need for an image-based dosimetry that provides greater spatial resolution and contrast than the current method provides.

Technology Description

Researchers at the University of New Mexico have developed positron-emitting surrogate microsphere for image-based dosimetry in Yttrium-90 radioembolization therapy. This surrogate positron emission tomography (PET) technology can be used to perform accurate dosimetry with greater spatial resolution and contrast than the current method. Development of a positron emitting surrogate microsphere and the means to use it in pre-treatment dosimetry can move treatment planning for Y-90 radioembolization towards a level of accuracy that is expected in other radiation therapy techniques such as brachytherapy and external beam therapy.

Application area

Provides greater spatial resolution and contrast
Conducted prior to therapy, this technique provides improved pretreatment dosimetry
Development of a computational technique to perform dosimetry with the surrogate microsphere

Institution

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