

Quantitation of the T cell anti-tumor response by positron emission tomography

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Non-invasive whole-body imaging methods to monitor the immune system would permit highly sensitive appraisal and localization of cells involved in anti-tumor therapy. We utilized positron emission tomography (PET) to evaluate the migration and expansion of adoptively transferred immune T lymphocytes. Splenic T cells from animals that had rejected a Murine Sarcoma Virus/Murine Leukemia Virus (MSV/MLV) induced tumor were marked with the HSV1-sr39tk PET reporter gene. MicroPET imaging of immunodeficient tumor-bearing mice injected with marked immune T cells, using the substrate FHBG, detected specific localization of immune T cells to the MSV/MLV antigen-positive tumor but not an antigen-negative control tumor. A 5-fold greater increase in signal over time at the site of the antigen-positive tumor was detected by sequential imaging of the same animals. The microPET signal was corroborated by digital whole-body autoradiography. Immunohistochemistry of tumor sections detected more T cells at the antigen-positive tumor as compared to the control tumor, corroborating the microPET analysis. Naïve T cells did not significantly localize to the antigen-positive tumor site when followed by microPET imaging or immunohistochemistry. This method demonstrated in rodents is useful for evaluating experimental models of cancer therapy and can be applied to the analysis of the immune response to human cancer, with currently available clinical PET and PET/CT technology.