

DETECTION OF SMALL MURINE LUNG TUMOURS BY FDG-PET



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Introduction: The functional information provided by 2-deoxy-2- [18F]fluoro-D-Glucose (FDG) positron emission tomography (PET) is commonly used to detect primary tumours and metastases in clinical studies. The aim of this work is to assess the possibilities of FDG-PET studies to detect small lung tumour lesions in mice, using a dedicated small animal PET scanner.

Materials and Methods: The study includes two groups of twelfthweek-old NOD/SCID mice: A) a Control Group (N = 10) and B) a Study Group (N = 6) in which animals were injected through the tail vein with human melanoma cells, that show a high tropism to lungs. PET scans in the Study Group were performed at two different time points (20 and 35 days), although three animals did not reach the second endpoint as they died during the anaesthesia in the first study. Animals in the control group underwent one only scan. After fasting for more than 12 hours before imaging, mice were intravenously injected with FDG (300-500 μ Ci). Following an uptake period of 40 minutes, mice were anaesthetized with Avertine and imaged during 40 minutes in a dedicated small animal PET scanner (1.8 mm FWHM). Images were reconstructed using a 3-D OSEM algorithm.

Results: Uptake of FDG in heart and bladder was clearly identifiable, as it also was, more variably, in dorsal muscles. In group B, 50% (3/6) showed small lesions in lung at Day 20. The other three mice showed a high FDG uptake in back muscles that prevented us from visualizing the tumours. Only three mice of the group B reached Day 35; lesions were observed in two of three mice. The third study was also non-conclusive because of high FDG uptake in back muscles.

Discussion: Two main artefacts were observed when using FDG-PET for the screening of small lung tumour lesions: muscle and myocardial FDG uptake. Muscle uptake may be decreased by using sedative drugs or extending the anaesthesia period. Decreasing myocardial uptake is less straightforward, since normal myocardial metabolism depends on both free fatty acids and glucose. Some measures to decrease myocardial uptake have been proposed, as for instance to control blood glucose levels (<120 mg/dl) and fasting duration (>12 h). Another observed artifact was an intense intestinal FDG uptake, that may be due to different factors such as smooth muscle activity, metabolically active mucus, intestinal microbial uptake, and even a possible irritative effect of the intraperitoneal anaesthesia: Avertine has been reported to develop intestinal complications due to local irritation after intraperitoneal injection, causing inflammation, pain and sometimes even causing the death of the animals.

Conclusions: A small animal PET scanner seems able to detect small lung tumours in mice using FDG, as early as 20 days of the injection. However, myocardial and back muscles FDG uptake impaired the monitoring of the developing lung tumours in a significant amount of cases. A change in the acquisition protocol seems advisable.