Animal PET in molecular imaging
Research
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Animal PET is useful for (1) basic research with typical non-invasive longitudinal follow up of animal models of specific diseases and evaluation of experimental treatment response (2) for the evaluation and selection of new PET-radiotracers and (3) for identification of new molecular imaging targets in specific pathologies.

For basic research in small animals, PET competes with other small animal in vivo imaging modalities such as fluorescence imaging and bioluminescence imaging that do not require on-site synthesis of expensive radiolabeled probes. In pharmaceutical industry, PET-radiotracers for a specific target are increasingly being developed parallel with development of new drugs for the same target so that radiotracers are available for early clinical evaluation of their new candidate drugs. Validation of new radiotracers generally involves pretreatment and chasing studies with compounds competing for the same target, or make use of knock-out mice lacking the target protein, or animal models with locally increased expression of the target protein.

Specific animal disease models may allow to identify up- or downregulation of primary or secondary targets for existing or new radiotracers that thus may have clinical diagnostic value.

Although PET is a translational technique, the results of small animal PET studies may not always be applicable to human studies due to (1) interspecies differences with regard to expression of the target protein, metabolism of radiotracer, BBB penetration of the radiotracer (2) interference of anesthesia with specific uptake of the tracer in the target tissue (3) relatively high doses (MBq/kg bodymass) that are injected in microPET studies as compared to clinical studies, that depending on the specific activity of the tracer may cause partial saturation of binding sites causing a reduction in specific binding of the tracer (4) relatively lower resolution of microPET systems compared to human PET scanners resulting in a relatively larger partial volume effect.

Full kinetic modeling in animal PET and especially in rodents requires frequent blood sampling which may be cumbersome but can be circumvented by using a micro betaprobe.

Cost reduction and increase of throughput of microPET studies can be achieved by scanning multiple animals in the same scanning session usually at the expense of resolution of the images that are obtained.

Specific microPET cameras are available to scan trained awake monkeys and rats that thus can be subjected to activations studies and do not suffer from interference with anesthetics.