

Most Innovative Honorable Mention 2007

¹⁸F-fallypride in hypothalamic DBS

Data courtesy of University of Wisconsin, Vandehey NT, Christian BT

Research Objective: To investigate the changes in D2 binding during hypothalamic Deep Brain Stimulation (DBS)

Imaging system(s): Siemens microPET P4

System Parameters:

Energy window: 350-650 keV
Coincidence timing window: 6 ns

Animal Model: Rhesus Monkey

Animal Size: 15 kg

Discussion: These images were obtained from a longitudinal study of a monkey with a deep brain stimulation electrode implanted into its right lateral hypothalamus. The monkey underwent four scans over 8 months. Scans were performed during periods of baseline (after surgery, before turning electrodes on), chronic high frequency (130 Hz), the end of a one month washout period with no stimulation and, chronic low frequency (50 Hz) DBS stimulation. Whole brain parametric images (Ichise, 2003) of ¹⁸F-fallypride DVR were calculated for each condition to track changes in both striatal and extrastriatal D2/D3 availability. PET images were registered to MRI. Percent change images are based on the following: $[(\text{scan} - \text{baseline})/\text{baseline}] \times 100\%$.

The PET methods used here reveal large changes in DA receptor availability in both extra-striatal and striatal regions during hypothalamic and thalamic DBS. During off-stimulation periods, receptor binding returns to baseline levels. Also regions with the highest concentration of DA receptors may shift within the striatum, suggesting regional changes rather than global changes within affected structures. One possible explanation for the observed changes is that they are a secondary effect of stimulation of the MFB, which is known to induce changes in DAergic systems. Further ¹⁸F-fallypride measurements in a larger cohort are warranted to provide a more definitive change in the DAergic system during LH DBS. These methods show great potential for providing insight into the neurochemical mechanisms of hypothalamic DBS, and warrant further use of neuroligand PET imaging in deep brain stimulation research.

Imaging Protocol: ⁵⁷Co transmission scan followed by 2-hour emission scan starting with tracer injection

Biomarker or Contrast Agent:
¹⁸F-fallypride

Activity, volume, concentration, injected: 5 mCi in 5ml saline, infused over 30 seconds, i.v.

