Ip-ntPET finds significant fast dopamine responses to cigarette smoking in sub-regions of the striatum

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ABSTRACT

We present a novel PET imaging approach for capturing dopamine fluctuations induced by cigarette smoking. Subjects smoked in the PET scanner. Dynamic PET images are modeled voxel-by-voxel in time by Ip-ntPET, which includes a time-varying dopamine term. The results are ‘movies’ of dopamine fluctuations in the striatum during smoking.

OBJECTIVE

To use Ip-ntPET imaging to detect and characterize transient dopamine elevations in the brains such as those we expect from smoking one or two cigarettes. For reasons why conventional methods fail, please attend Oral Presentation #2 in Session 7 at 9:48 am on Sat. Aug. 11, “O26: Limitations of SRTM, Logan Plot, and Equilibrium Analysis for Measuring Transient Dopamine Release in [11C]Raclopride PET Studies,” J. M. Sullivan et al.

METHODS

Methods for acquiring and processing image data are summarized in Figures 1 and 2. Two women and two men smoked 1 (n=1) or 2 (n=3) cigarettes in the middle of the scan while in the scanner. Each subject underwent two bolus+constant infusions of 11C-raclopride with imaging for at least 90 min. To eliminate motion artifacts due to smoking, while in the scanner. Each subject underwent two bolus+constant infusions of 11C-raclopride, motion correction via a Vicra laser system and event-by-event motion correction (Carson, 2003). To ensure the absence of cigarette smoking. Some keys to our method are: (a) event-by-event motion correction, (b) bolus+infusion tracer administration, (c) HYPR filtering of PET data, (d) Prepare subject

Preprocessing

1. Registration of PET to MR template
2. HYPR filtering of PET

METHODS Overview

Apply Models

Select a basis function

Create F-map

Candidate F-maps are created

Compare WSSR

Select significant movies

Create F-map of significant voxels

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CONCLUSIONS

We have detected short (5-15 min) and highly localized (smaller than common subdivisions of striatum) responses of the dopamine system of smokers to smoking cigarettes. These transient responses are not found in control scans of the same subjects, absent cigarette smoking. Some keys to our method are: (a) event-by-event motion correction, (b) bolus+infusion tracer administration, (c) HYPR filtering of PET data, (d) time-varying model of dopamine function, (e) statistical determination of significant responses, (f) morphological filtering of F-maps, and (g) visualization of responses as spatio-temporal movies.

REFERENCES