Construction of different radionuclide templates of rat brain and their use on a new statistical parametric mapping analysis protocol for PET studies

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Introduction

**Statistical Parametric Mapping**

- SPM is rarely used in animals
- SPM permits automatic analysis avoiding operator variability implicit in the definition of VOIs (Volume of Interest)
- Spatial normalization is needed for running SPM analysis of rat brains
- Use PET templates for SPM analysis in rat brain studies
Aim

Develop a protocol to create PET templates

Templates needed for spatial normalization in rat brain images

Normalised rat brain images used for running SPM analysis

- If we already have PET templates, no MRI would be required for spatial normalization
Methodology

Eleven *Sprague-Dawley* Rats

- MRI: Bruker Biospec BMT 47/40 (UCM, Madrid)
  4’7 teslas Spin-eco T2
  MRI \( N = 11 \)

- μPET: Philips MOSAIC (CIMA-CUN, Pamplona)
  \( ^{18}\text{F-FDG} \)
  \( N = 11 \)
  \( ^{11}\text{C-DTBZ} \)
  \( N = 6 \)
  conscious rats
  \( N = 11 \)
  anaesthetised rats
  \( N = 11 \)
Methods: template creation

- PET-MRI Coregistration
- Individual MRIs
- Individual PETs
- Masking
- Template MRI
- Normalized PETs
- Transformation Matrix
- Average
- Smooth
- 2 iterations
- Final PET template
Methods: SPM analysis

- Paired t-test

conscious rats → Paired t-test → anaesthetised rats

\( p = 0.05 \)

- SPM Design Matrix

Design description:
- Design: Population main effect; 2 cond’s, 1 scan/cond (paired t-test)
- Global calculation: mean voxel value (within per image full/meanX mask)
- Grand mean scaling: (implicit in PropGrid global normalisation)
- Global normalisation: proportional scaling to 50
Results: our templates

- $^{18}$F-FDG template
  - conscious rats

- $^{18}$F-FDG template
  - anaesthetised rats

- $^{11}$C-DTBZ template
  - anaesthetised rats
Results: SPM analysis

3D

Conscious rats >> Anaesthetised rats

p = 0.05
Conclusions

The developed protocol permits the creation of different PET templates of rat brain.

The decreased metabolism in the level of cortex in anesthetized animals was assessed using SPM.

The results agree with previous data in the literature.