AN AUTOMATED PIPELINE FOR CENTILOID QUANTIFICATION OF AMYLOID LOAD USING MULTIPLE PET TRACERS

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BACKGROUND

- The Centiloid scale was introduced to standardize in vivo quantitative amyloid plaque estimation by Positron Emission Tomography (PET).
- The purpose of this study was to develop a single and fully automated Centiloid quantification pipeline for multiple amyloid PET tracers.

MATERIALS & METHODS

Level-1 Centiloid Replication Analysis

- PiB and T1-MRI images of Young Controls (YC) and Alzheimer's Disease (AD) patients (N = 79) from the Centiloid project[1] were processed with a fully automatic SPM12-based pipeline, comprising the following steps:
  - coregistration of the PET image to the T1-MRI image,
  - spatial normalization of the T1-MRI image into the MNI space,
  - application of the normalization parameters to the PET image,
- Standardized Uptake Values ratios (SUVr) were computed by dividing the average uptake value in the cortex by the average value in the whole cerebellum using volume of interests from the Centiloid Project.
- Correlation between PiB local SUVr values and published SUVr data was then computed.

Level-2 Calibrations

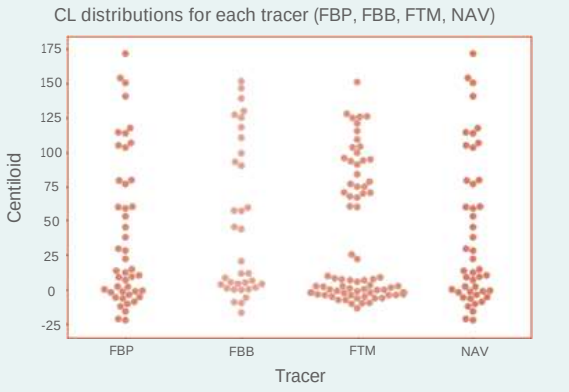
- T1-MRI and paired C11 PiB-PET & F18 PET images from the Centiloid project were used.
- F18 Tracers were Florbetapir[2] (FBP, N=46), Forbetaben[3] (FBB, N=35), Flutemetamol[4] (FTM, N=74) and NAV4694[5] (NAV, N=55).
- MRI and PET images were processed with the same pipeline used in Level-1.
- Correlation coefficients (R^2) > 0.7 between F18 SUVr and paired PiB SUVr were required to consider the CL calibration valid.
- Equations for converting F18-SUVr values to CL were then derived.

[1]Klunk WE et al. 2015; [2]Navitsky M et al. 2018; [3]Rowe CC et al. 2017; [4]Battle MR et al. 2018; [5]Rowe CC et al. 2016

RESULTS

Level-1 Centiloid Replication Analysis

Validation results were within the bounds defined by the CL method (SUVr_AD-100 = 2.08 +/- 0.2; SUVr_YC-0 = 1.01 +/- 0.05; R^2 = 1.00; slope = 1.00; intercept = -0.1)



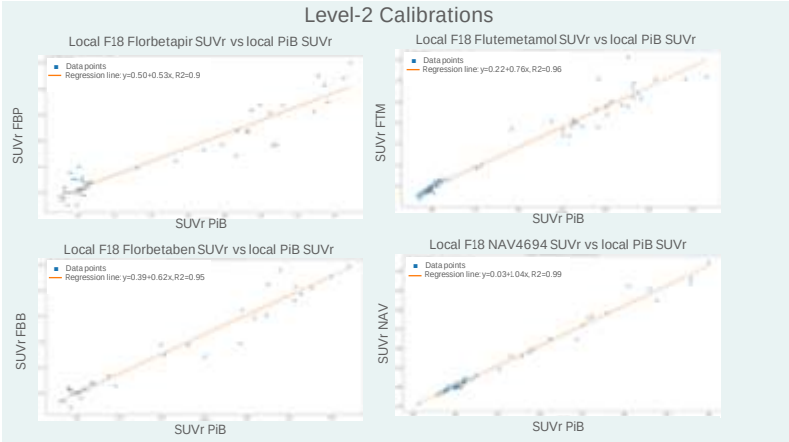
Level-2 Calibrations

Correlations between F18 to PiB were within the bounds defined by the Centiloid method :

FBP: R^2 = 0.91
FBB: R^2 = 0.95
FTM: R^2 = 0.96
NAV: R^2 = 0.99

This led to the following equations for SUVr to CL conversion:

FBP: CL = 177.79 SUVr – 183.56
FBB: CL = 153.08 SUVr – 152.93
FTM: CL = 122.39 SUVr – 120.97
NAV: CL = 90.20 SUVr – 91.61



CONCLUSION

We demonstrated the feasibility of a fully automated amyloid PET pipeline for multiple amyloid-PET compounds suitable for implementation in clinical trials.