Regional differences of Amyloid PET SUVR induced by spatial smoothing and the role of reference region

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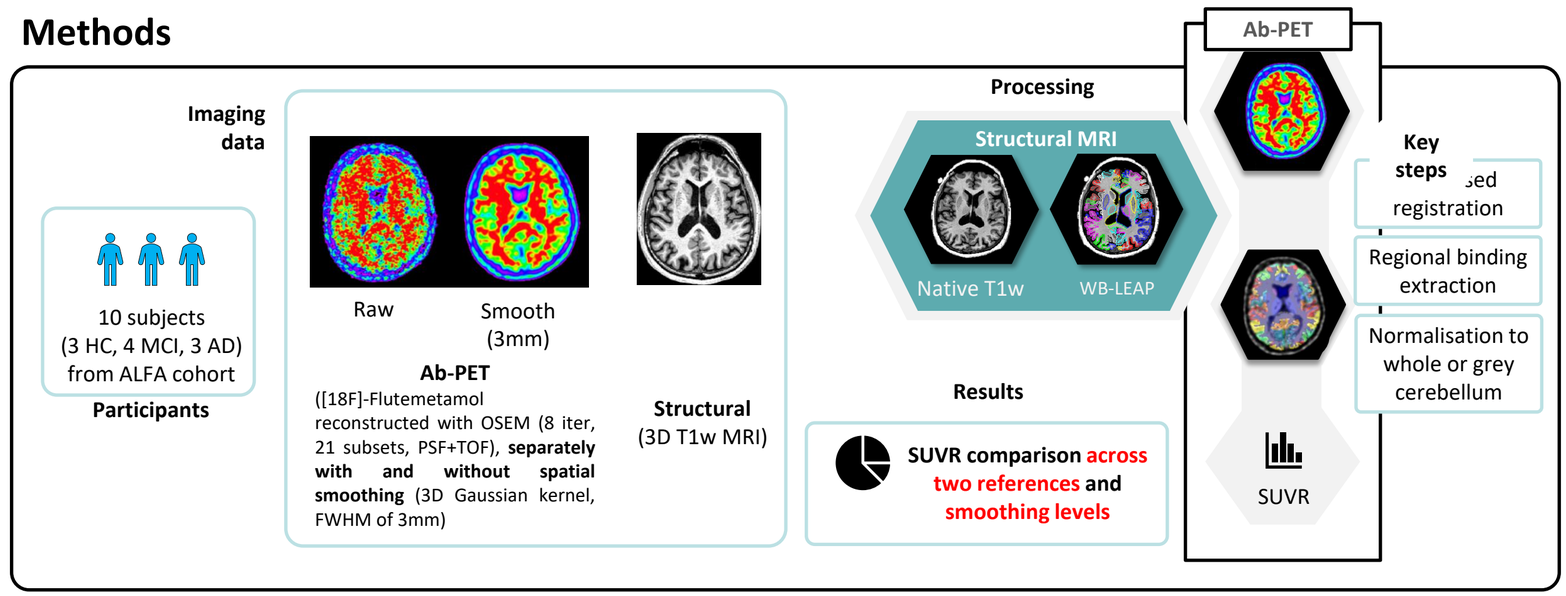
Introduction

- Current standard for clinical trials applications of Amyloid PET (Ab-PET) requires visual or semi-quantitative uptake assessment
- Spatial smoothing of Ab-PET scans can improve the analysis process by decreasing the noise level and improve tissue delineation to ease the eventual registration to a structural scan.
- In this study, we assessed the impact of post-reconstruction spatial smoothing the regional differences of Ab-PET in a mixed HC/MCI/AD cohort.

Methods



Results

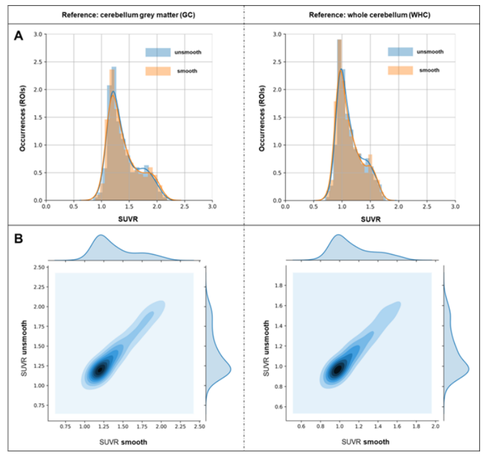


Figure 1. Amyloid-PET SUVR distribution unsmooth/smooth across all brain regions (top row) and their agreement (bottom row) with cerebellum grey matter (left) or whole cerebellum reference region.

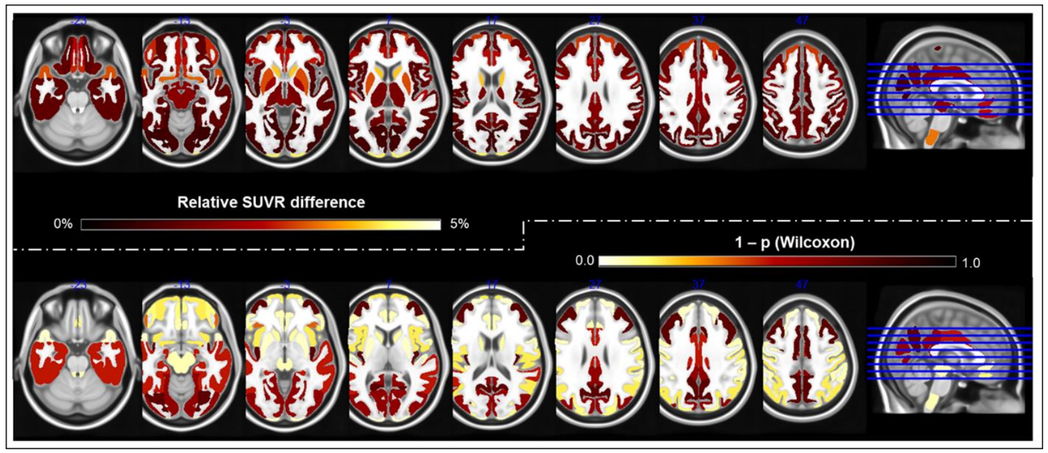


Figure 2. SUVR difference between unsmooth – smooth (relative to their average) in all brain regions (top row) and associated significance of each regional difference (bottom row).

- SUVR **significantly differed** between smoothed/raw (Wilcoxon signed-rank test, $p < 0.05$) with both reference regions.
- SUVR differences between smoothing levels → regionally limited (*Figure 1A*), **relative difference = -0.149% (GC) or +0.988% (WHC)**. Differences have small size effects → **Cohen's d = -0.014 (GC) and 0.046 (WHC).**
- A strong correlation (*Figure 1B*) across smoothing levels both regarding GC ($r = 0.984$, $p < 0.05$) and WHC ($r = 0.985$, $p < 0.05$).
- SUVR **relative differences between smoothing levels within 5%** threshold, not reaching significance (*Figure 2*) correcting for multiple-comparisons.

Conclusions

- **Smoothing-related SUVR differences within scan-rescan physiological level** [Tolboom; JNM;2009] → little impact on statistics
- **Smoothing can improve PET-MRI registration robustness** by tissue delineation and noise content in automatic analysis

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