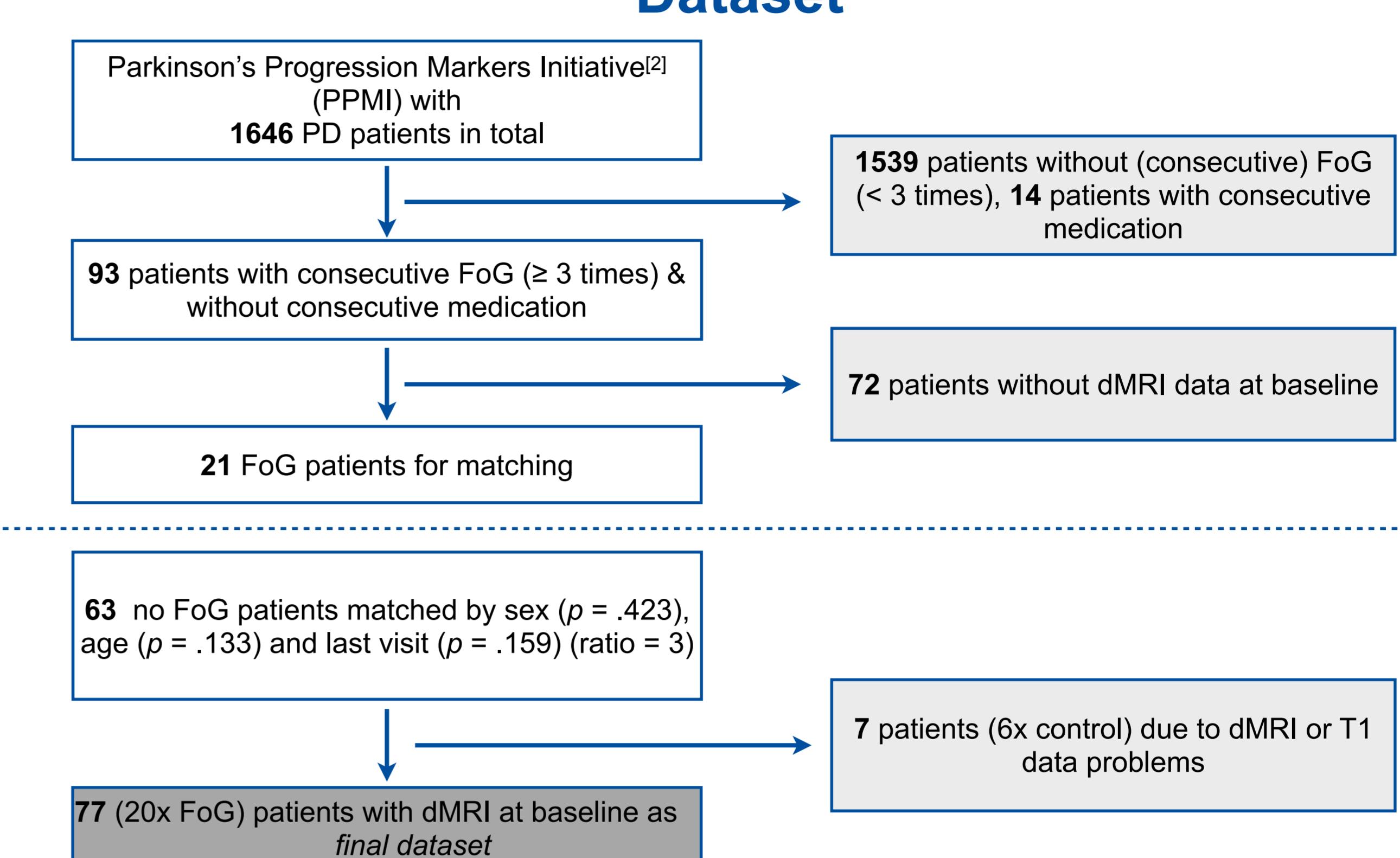


The brain in Parkinson's Disease: Structural connectivity analysis in Freezing of Gait patients

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Introduction

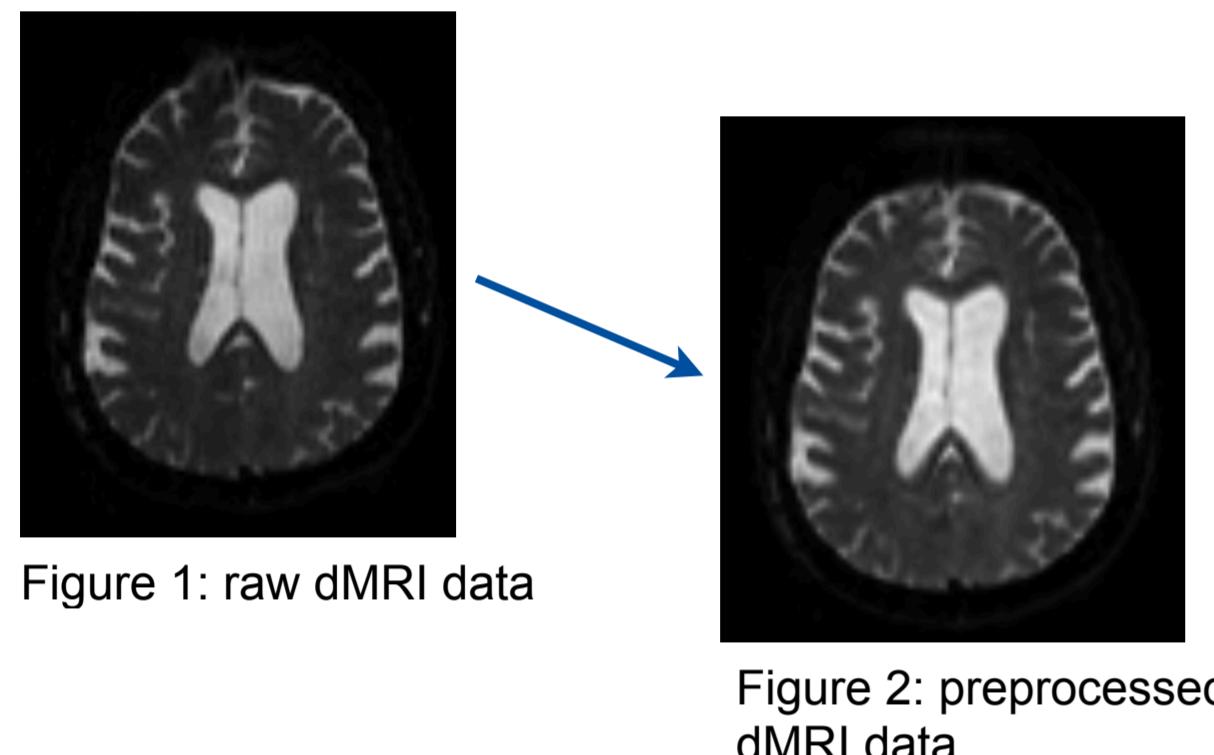
- Parkinson's Disease (PD) as second most common neurodegenerative disorder
- specific motor impairment: Freezing of Gait (FoG)
 - various subtypes, complete akinesia most severe^[4, 6]
 - dangerous falls & injuries possible^[3]
- in literature no homogenous picture of origin & treatment of FoG
 - e.g. FoG responsive or resistant to L-Dopa (most common PD medication)^[4]
- objective: analysis of structural connectivity differences between supplementary motor area (SMA) & thalamus in no FoG and FoG PD patients using diffusion MRI (dMRI) data
- expected: right hemisphere increased structural connectivity (SMA & thalamus) in FoG patients at baseline^[1]



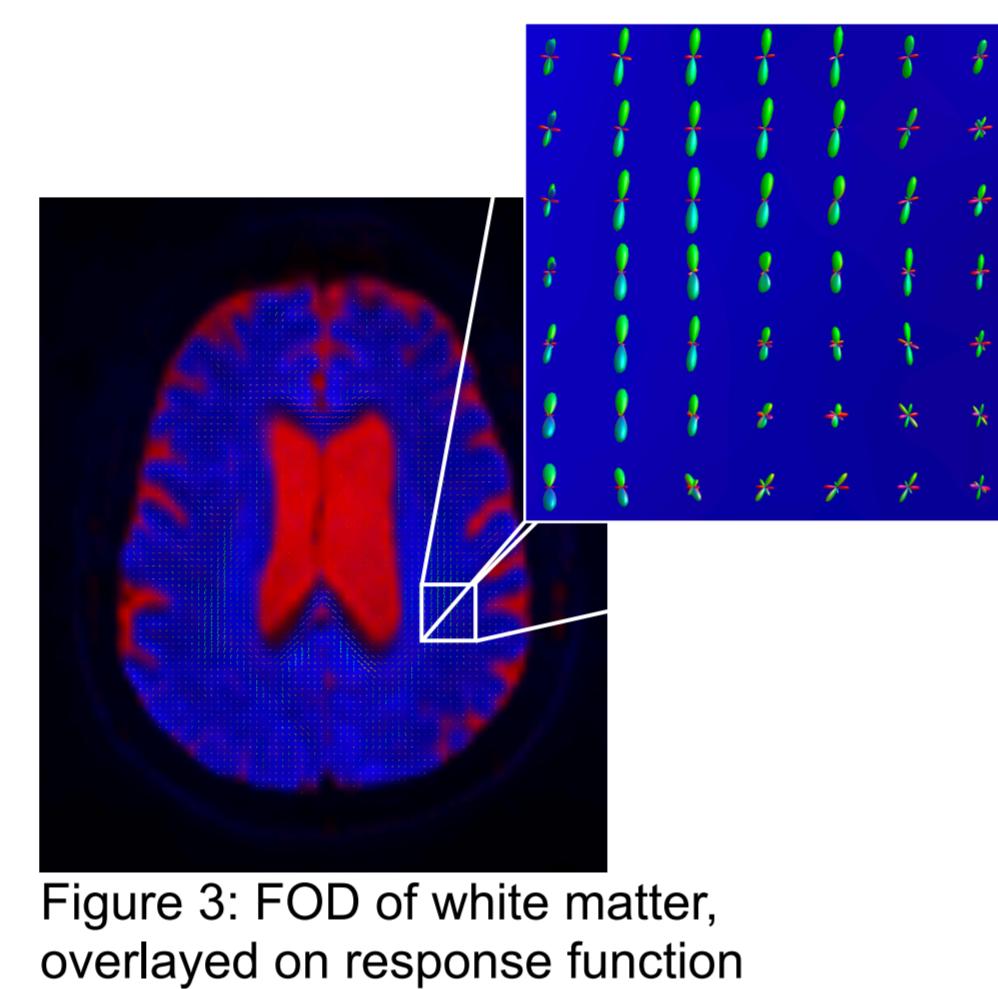
Methods

Data processing

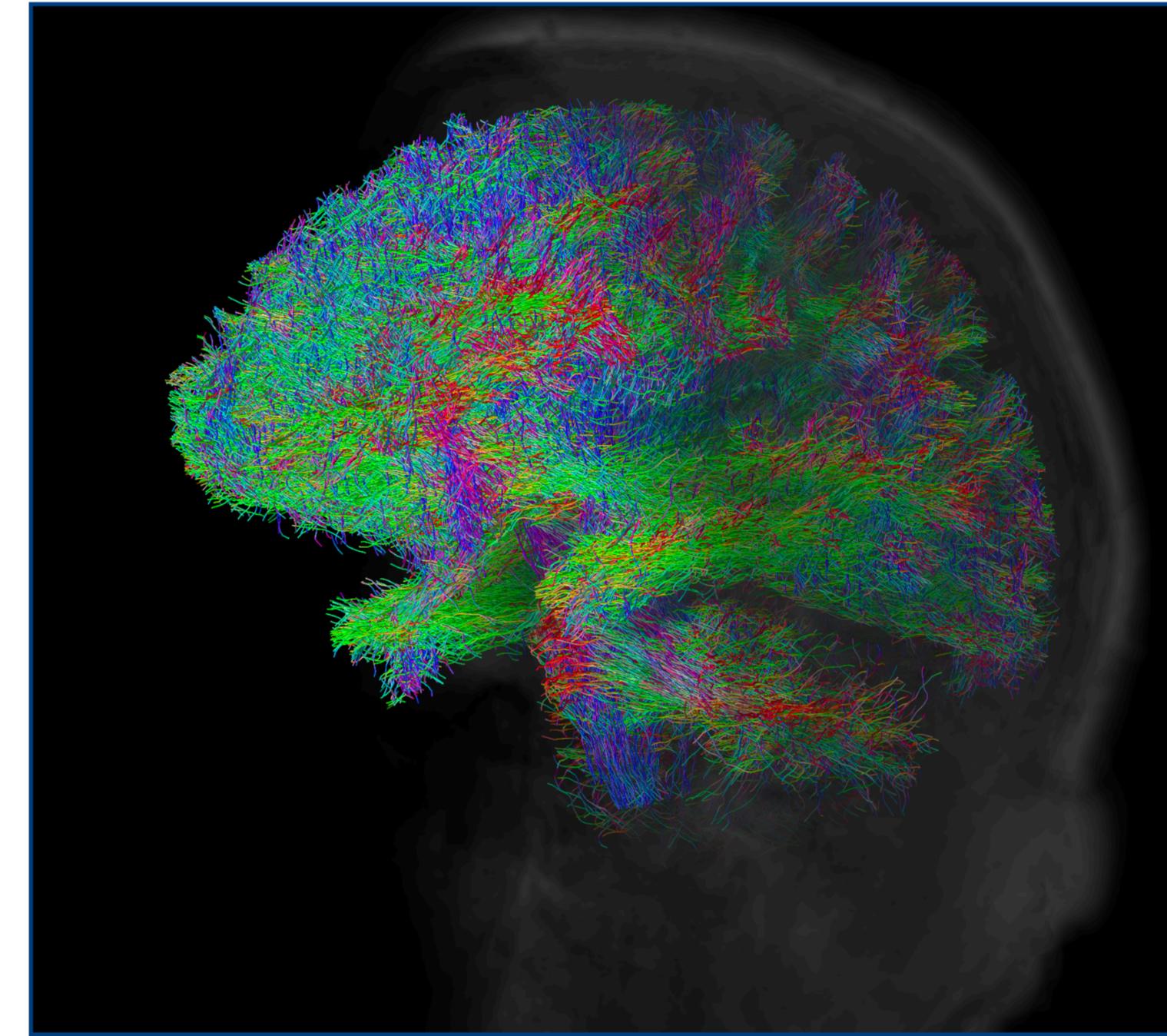
Following the B.A.T.M.A.N. tutorial^[5]:



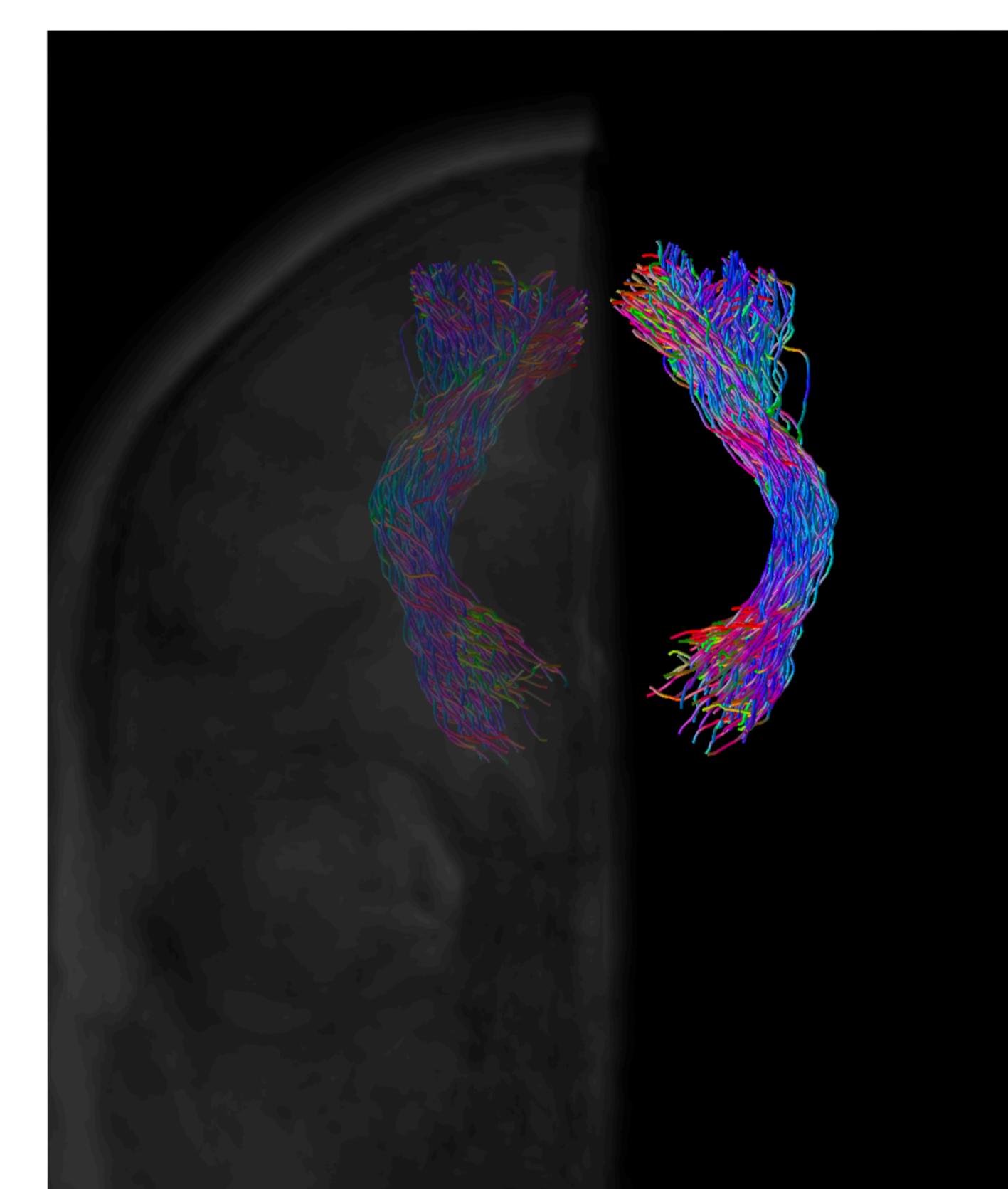
1) Preprocessing of dMRI data



2) Estimation of Fiber Orientation Distribution (FOD)



3) Creation of Anatomically Constrained Tractography of whole brain



Statistical comparison of structural connectivity of FoG patients and PD control

- calculation of absolute streams between SMA and thalamus
- normalisation of amount for inter-patient comparison
- calculation of multiple regression for each hemisphere including possible covariates (sex & age)

Analysis

Results

Structural connectivity comparison of SMA and thalamus in FoG vs. no FoG patients:

Multiple regression in left hemisphere

($F(3, 73) = 3.41, p = .022, \text{adj. } R^2 = .087$)

- significant higher structural connectivity ($p = .010$) in male patients
- no significant group differences in FoG vs. no FoG

Multiple regression in right hemisphere

($F(3, 73) = 4.40, p = .007, \text{adj. } R^2 = .118$)

- significant group differences ($p = .019$) in structural connectivity in FoG vs. no FoG patients

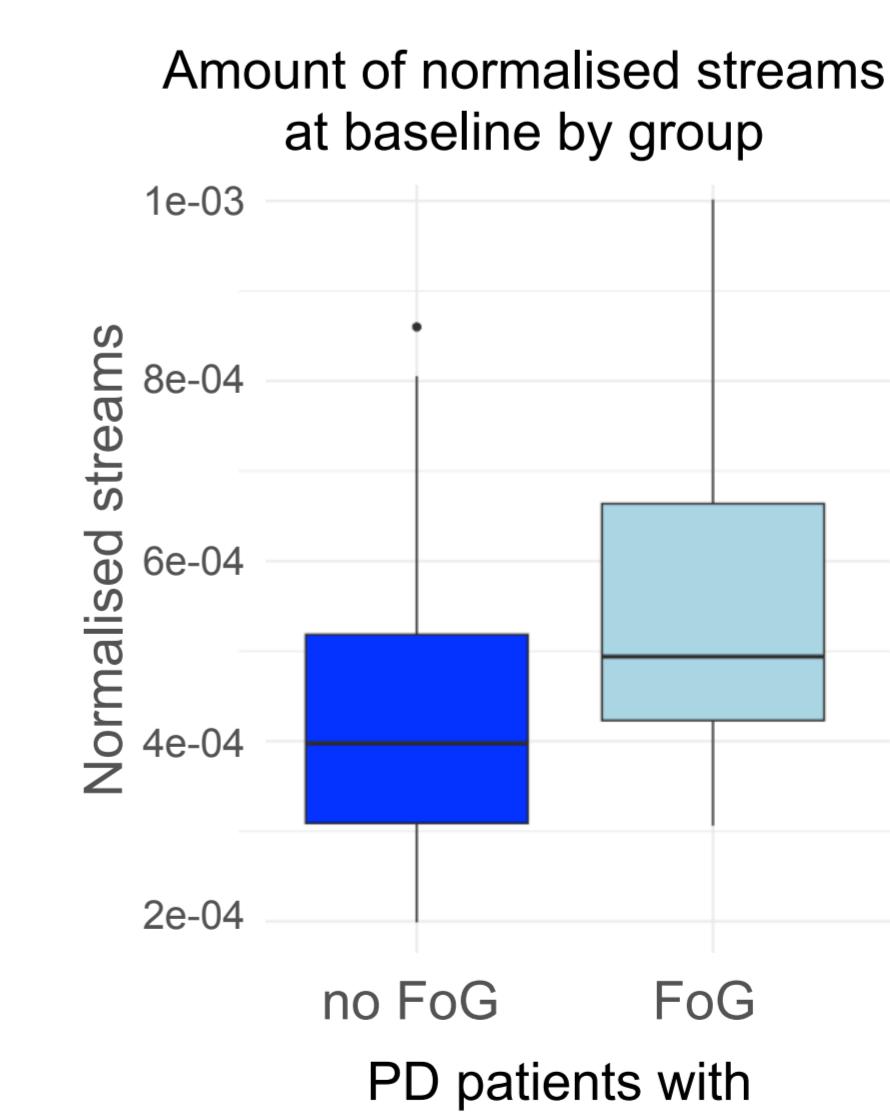


Figure 6: Boxplot of normalised amount of streams in FoG vs. no FoG patients ($t(29.56) = 2.66, p = .012$)

Discussion

- amount of normalised streams in FoG vs. no FoG patients increased
- RH structural connectivity higher in FoG patients at baseline:
 - might result from compensatory mechanism in PD brain^[1]
 - might be predictive marker for future FoG

Follow-up studies should evaluate, if:

- FoG vs. no FoG structural connection still alters with longer duration of disease.
- the structural connectivity can be used as more reliable predictor for FoG than the Unified Parkinson's Disease Rating Scale.

Literature

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- [4] Snijders, A. H., Takakusaki, K., Debu, B., Lozano, A. M., Krishna, V., Fasano, A., Aziz, T. Z., Papa, S. M., Factor, S. A. & Hallett, M. (2016). Physiology of freezing of gait. *Annals of neurology*, 80(5), 644–659.
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