Exploring Correlations between Age of Onset and Parkinson's Disease Progression using Linear Regression

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Abstract

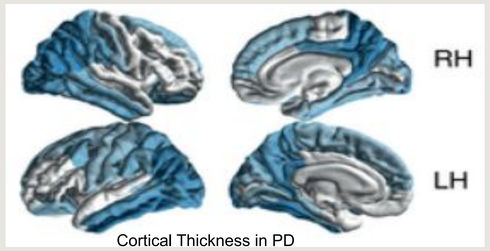
Background: Parkinson's Disease (PD) Is a neurodegenerative disorder that is characterized by motor and non-motor symptoms. There are 3 types, which are denominated by the Age of Onset (AO).

Objective: To explore the correlation between the Age of onset and progression of Parkinson's Disease.

Methods: I used data that was collected from the site located in Charlottesville in the ENIGMA consortium via MRI scans and analyzed it using python.

Results: As the AO increases so does the volume of the lateral ventricles, but the mean thickness of the cortex and of the superior temporal lobe decreases.

Conclusions: As the AO increases PD progresses faster. The younger a person gets PD the slower it progresses and the less severe it is. This also means a slower decline and a risk of Dementia



Cortical Thickness in PD

```
cleaned_data = data.dropna(subset=['AO', 'R_superiortemporal_thickavg'])

data_M = cleaned_data[cleaned_data['Sex'] == 'M']
data_F = cleaned_data[cleaned_data['Sex'] == 'F']

correlation_M, pvalue_M = stats.pearsonr(data_M['AO'], data_M['R_superiortemporal_thickavg'])
r_squared_M = correlation_M**2

correlation_F, pvalue_F = stats.pearsonr(data_F['AO'], data_F['R_superiortemporal_thickavg'])
r_squared_F = correlation_F**2

slope_M, _, _, _, _ = linregress(data_M['AO'], data_M['R_superiortemporal_thickavg'])
print("Slope for 'M' gender: {:.3e}".format(slope_M))

slope_F, _, _, _, _ = linregress(data_F['AO'], data_F['R_superiortemporal_thickavg'])
print("Slope for 'F' gender: {:.3e}".format(slope_F))
```

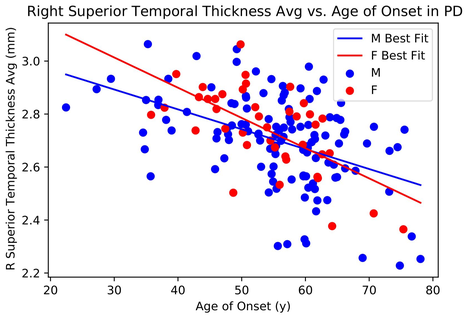
Background

Parkinson's Disease (PD) is a neurodegenerative disorder that is characterized by motor and non-motor symptoms. There are 3 types, which are denominated by the Age of Onset (AO). Young Age of Onset (YOPD) is until 49 years old, Middle Age of Onset (MOPD) is 50 – 69 years old, and Late Age of Onset (LOPD) is from 70 years old and onwards (Mehanna et al.). The AO is one of the main determining factors in the progression of PD. AO along with some other factors can determine the progression and path of PD in a patient.

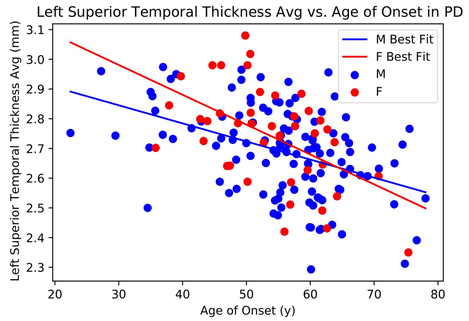
Methods

I used data that was collected from the site located in Charlottesville in the ENIGMA consortium via MRI scans and analyzed it using python. Certain subjects were excluded, and a total of 159 subjects (40 Females and 119 males) were analyzed. I then analyzed and plotted the data using linear regression in python using Matplotlib. I then used python and linear regression to calculate the p-values and the slopes.

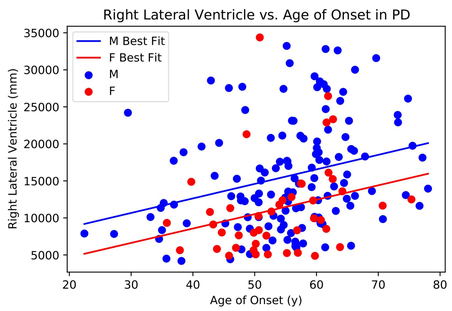
Graphs and Tables



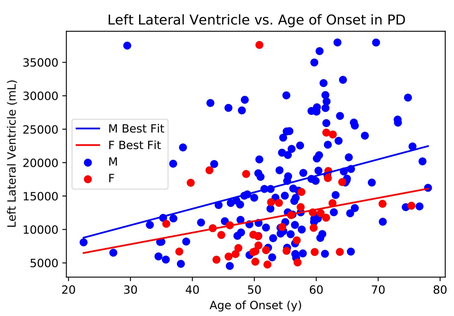
P values < 0.05 vs age of onset
M – Male, F – Female (fig. 1)



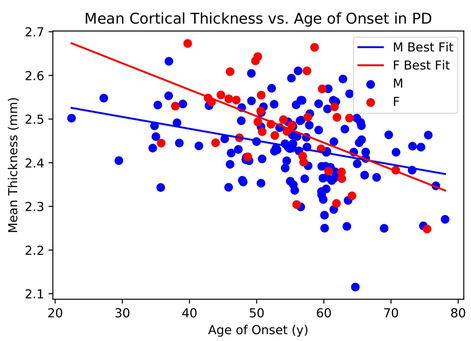
P values < 0.05 vs age of onset
M – Male, F – Female (fig. 2)



P values < 0.05 vs age of onset
M – Male, F – Female (fig. 3)



P values < 0.05 vs age of onset
M – Male, F – Female (fig. 4)



P values < 0.05 vs age of onset
M – Male, F – Female (fig. 5)

Graph	P-Value	Slope
Mean Thickness	M = 2.88e-04 F = 4.26e-04	M = -2.72e-03 F = -6.07e-03
R Lateral Ventricle	M = 9.25e-04 F = 8.73e-02	M = 1.96e+02 F = 1.94e+02
L Lateral Ventricle	M = 1.77e-04 F = 1.34e-01	M = 2.46e+02 F = 1.73e+02
R Superior Temporal	M = 1.36e-07 F = 1.16e-05	M = -7.51e-03 F = -1.14e-02
L Superior Temporal	M = 9.69e-07 F = 5.35e-04	M = -6.09e-03 F = -1.01e-02

P values < 0.05 vs age of onset
Figures describe the relationship of the variable with an increase in the age of onset in PD.
M (Blue) - Male
F (Red) - Female

Results and Conclusions

Results: The age of onset (AO) affects the mean cortical thickness, The lateral ventricle volumes, and the superior temporal thickness. The increase in AO is positively correlated with an increase in Lateral ventricle volume. The increase in AO is negatively correlated with a decrease in mean cortical thickness and superior temporal thickness.

Conclusions: The Mean cortical thickness (fig. 5) and the superior temporal thickness (fig. 1 and 2) decreased as the AO increased. While the lateral ventricle volumes (fig. 3 and 4) increased with the increase in AO. This can be attributed to the fact that PD progresses slower in young onset PD (Klepac et al.). As the AO increases the effects of PD show up faster and are more severe. Whereas those who get PD at a younger age progress slower through the disease. This also means they have a slower decline and acquire the risk to develop Dementia during later stages of PD (Aarsland et al.).

Next Steps: With this information, in the future I hope to expand the data set to include more subjects from a variety of locations, as well as include more factors that influence PD and regions of the brain.

References and Acknowledgements

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