Parkinson’s disease detection using 3D Brain MRI FA map histograms correlated with tract directions

PURPOSE

The fractional anisotrophy (FA) in diffusion tensor imaging (DTI) has been shown to be sensitive to changes in the substantia nigra in Parkinson's disease (PD) and correlating with clinical severity. The purpose of this study is to evaluate if the density of tracts running in an anterior-posterior direction in the midbrain, is a sensitive indicator of degeneration of the striatonigral tracts in the midbrain.

METHOD AND MATERIALS

35 Patients diagnosed clinically with PD underwent DTI imaging (TR/TE 4300/90; 12 directions; 4 averages; 4/0 mm sections; 1.2 x 1.2 mm in-plane resolution) after giving informed consent. The FA color map at the slice that contains substantia nigra and red nucleus is cropped and split according to the three color channels (RGB) using imageJ toolkit. Assuming that the striato-nigral tracts run more in an anterior-posterior rather than superior-inferior direction, the green channel from the color map is analyzed. The clinical demographics, number of green pixels per unit area, and using SPSS Statistics were tabulated and compared between patients using the student t test. Using the H&Y scaling we have the ground truth for performing our studies. We correlate this scale with the variation of the pixel number in the green channel extracted from the cropped region of interest (ROI) defined. We use 12 pixel intensities (20-35) that are present in a different amount for each patients. This amount for each of the intensities can be correlated with the PD degree represented by H&Y scale.

RESULTS

Our preliminary findings show that using the green channel histogram values for pixels intensities between 21 and 35 we are able to classify the PD patients. Computing the P values we obtained values between 0.001 for pixel 35 and 0.009 for pixel 22 on the green channel. Performing a classification based only on the pixel values we have an overall success rate between 10-40%, depending on the number of patients used.
### CONCLUSION

Our preliminary study shows that based on the green channel histograms from FA maps we could predict the PD degree and classify patients like in the H&Y scale.

### CLINICAL RELEVANCE/APPLICATION

This method can classify the patients according to the PD severity using just the FA colored image and represents a marker for the PD patients.