Purpose & Objectives
Clinical diagnosis of parkinsonism can be challenging particularly early in the disease or for those patients with atypical symptoms. DaTscan (1123-ioflupane) is a SPECT radiotracer that has been used to help differentiate patients with essential tremor from presynaptic Parkinsonian syndromes. DaTscan binds to the dopamine transporters of striatal dopaminergic neurons and shows a decrease in uptake with loss of dopaminergic neurons. Our goal is to evaluate an automated atlas-based method for the analysis of DaTscan SPECT to aid in the differentiation of Parkinson Disease (PD) from healthy controls (HC).

Methods & Materials

Image Data:
Sixty subjects with DaTscan SPECT (30 PD and 30 HC) were selected from the Parkinson’s Progression Markers Initiative database. Ten PD and HC were selected for each decade from 50-59, 60-69, and 70-79.

Data Processing:
Images were automatically aligned to a PD and HC template simultaneously using a 9-parameter affine registration. Pre-defined atlas volumes of interest (VOIs) were then transferred to the patient image from the template space using the registration parameters. Uptake ratios were computed, including occipital normalized putamen (PUT), anterior putamen (ANT_PUT), posterior putamen (POST_PUT), caudate (CAU), and striatum (STR), caudate normalized putamen (PUT/CAU), and asymmetry indices for the putamen (ASYM_PUT) and striatum (ASYM_STR). The asymmetry indices were computed as the absolute difference between the left (L) and right (R) sides divided by the mean of both sides: \(2|\text{ABS}(L-R)| / (L+R)\).

Results
For the 50-59 age range, all ratios were significant (p < 0.05), with the exception of CAU (L, R, and combined) and ANT_PUT. ASYM_STR was the most powerful ratio and separated HC from PD with 95% accuracy. For the 60-69 age range, all ratios were significant (p < 0.05), with the exception of POST_PUT (L), CAU (combined), and ASYM_PUT. PUT/CAU was the most powerful ratio and separated HC from PD with 90% accuracy. For the 70-79 age range, all ratios were significant (p < 0.05), with the exception of ASYM_PUT and ASYM_STR. ANT_PUT was the most powerful ratio and separated HC from PD with 95% accuracy.

Conclusion
An automated atlas-based method for DaTscan SPECT analysis demonstrated the potential for 90-95% accuracy for differentiating PD from HC using uptake ratios. Future studies with a larger cohort are planned to investigate these findings further.

Reference