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I-123 DaTSCAN SPECT Imaging: Evaluating striatal semi-quantitative analysis

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1. Background-Aim

- DaTSCAN is a specialized imaging modality that assesses the integrity of dopamine transporters in the brain by performing a striatal analysis utilizing Iodine-123 (I-123). Its main application is to support the identification of neurodegenerative conditions, including Parkinsonian Syndromes (PS)[1,2].

- Typically, diagnostics rely on visual assessment, although most vendors provide semi-quantitative analysis[3].

The objective of this study is to assess a set of such quantification parameters provided by software in order to estimate their diagnostic accuracy and potential clinical utility.

2. Materials & Methods

- 29 patients (21 male/8 female, age bracket:60 - 80 years) were referred for **DaTSCAN imaging due to suspected Parkinsonian Syndrome (PS).**

- **Imaging and Analysis**: Images were obtained with Siemens Symbia Intevo 6 SPECT/CT system and analyzed with Syngo.via software. An experienced Nuclear Medicine physician conducted a visual assessment of the images.

  Images were classified as:
  - **Positive** for PS (12 cases)
  - **Negative** for PS (17 cases)

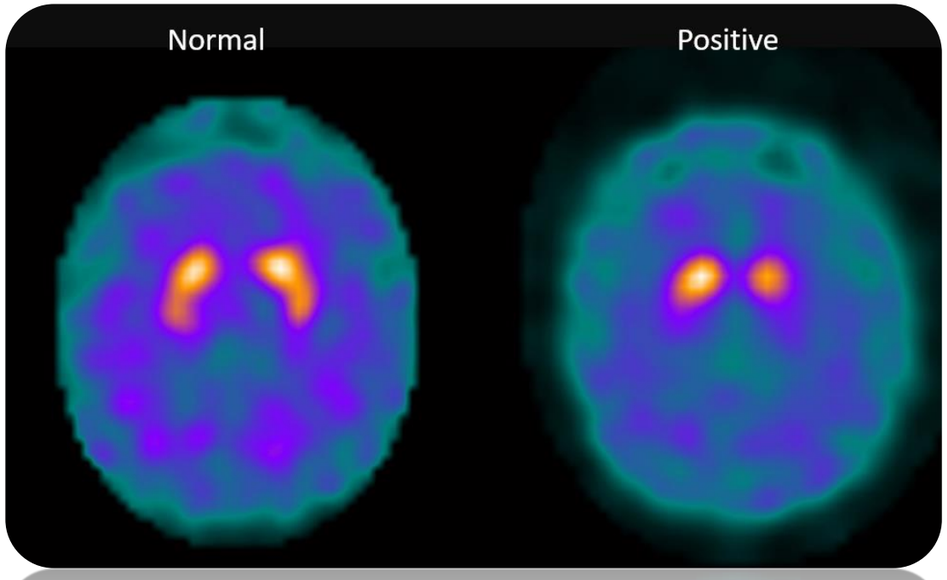


Figure 1. Representative DaTSCAN images, of negative and positive scans for PS.

2. Materials & Methods

Quantitative Parameters:

Several critical metrics were measured and analyzed:

- **Distribution Volume Ratios (DVR)**
- **Z-scores**
- **Asymmetry values**
- **Indices evaluated: Putamen-to-Caudate Ratio (PCR)** and **Putamen-to-Striatum Ratio (PSR)**

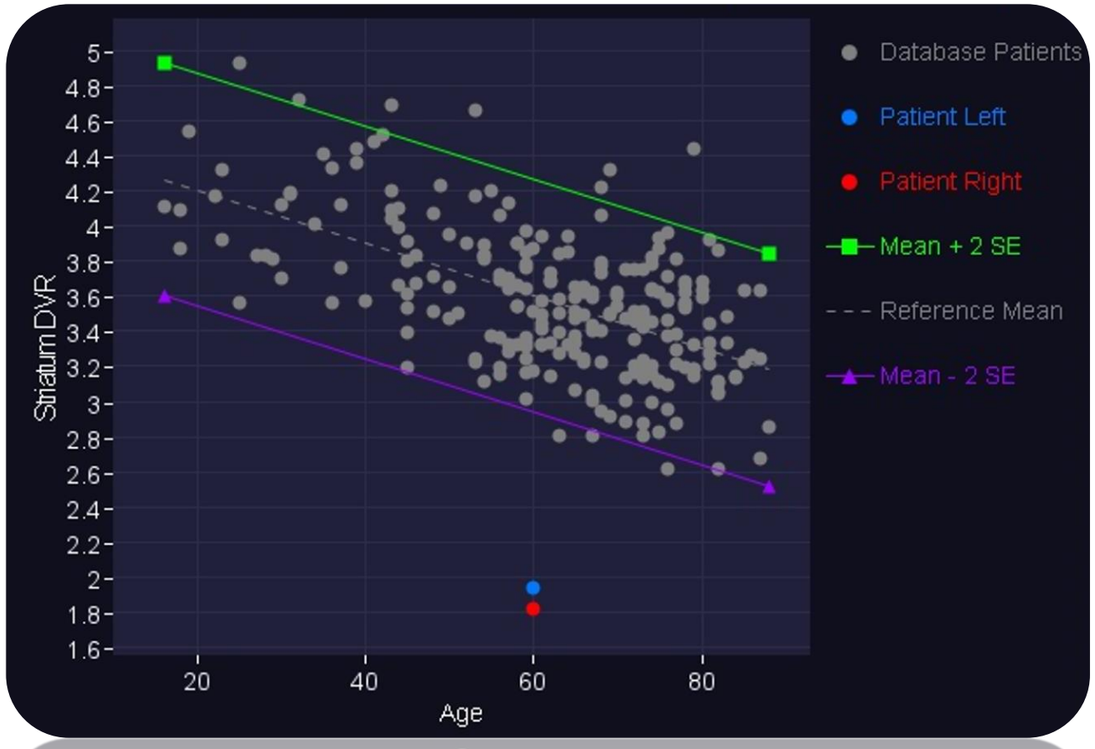


Figure 2. Z-Score depiction. A measure to assess variability in comparison to a Database of normal examinees.

2. Materials & Methods

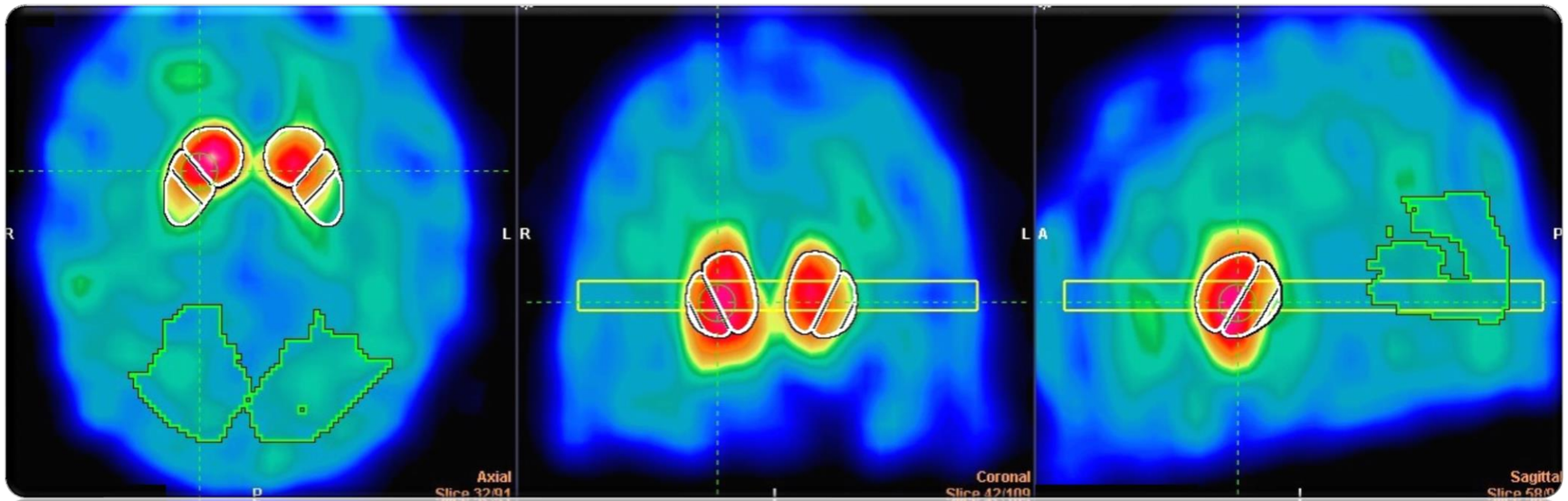


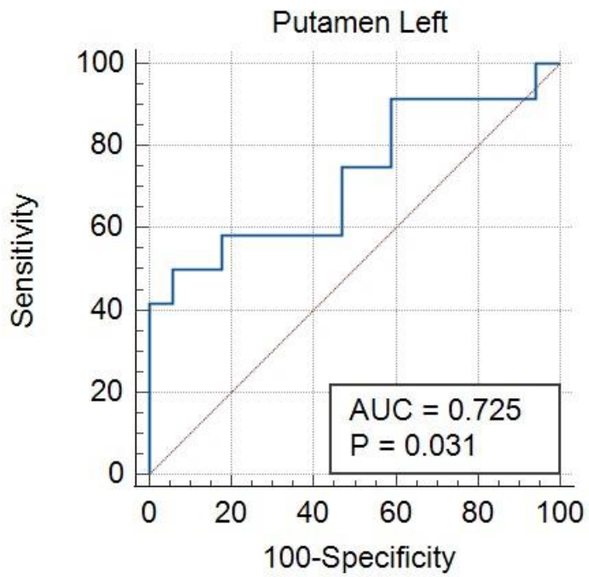
Figure 3. DaTSCAN views of a positive case (69Y).

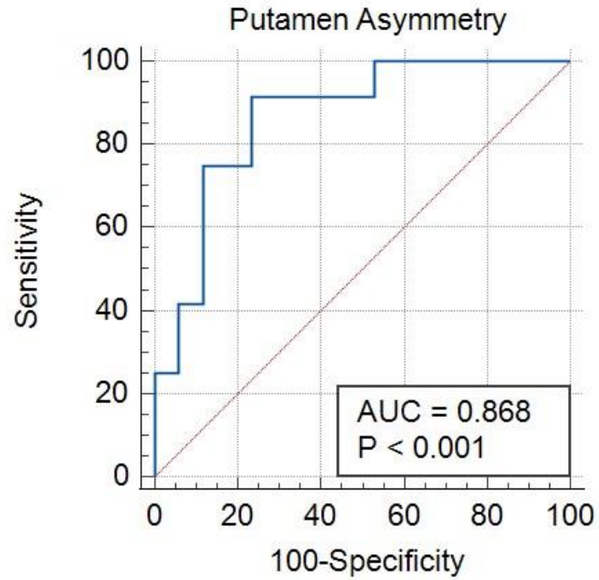
Statistical Analysis: A range of statistical methods were used to assess the data:

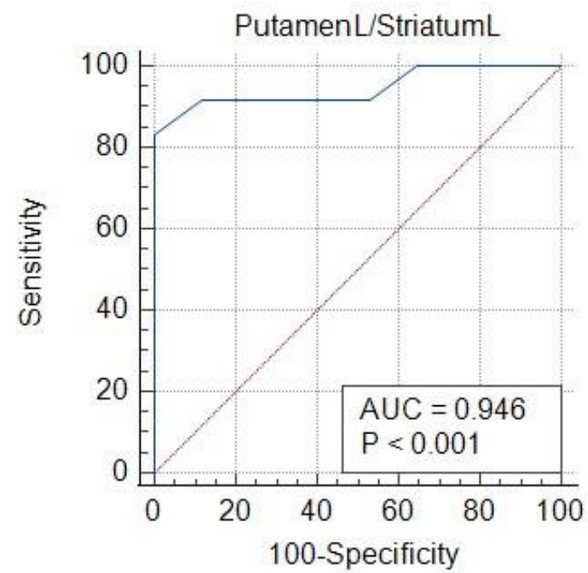
- **Cohen's κ coefficient** to evaluate inter-rater reliability
- **Independent samples t-test** to compare means between groups
- **Mann-Whitney test** as a non-parametric alternative for comparing distributions
- **Receiver Operating Characteristic analysis (ROC)** to compare the metrics with the physician's diagnosis

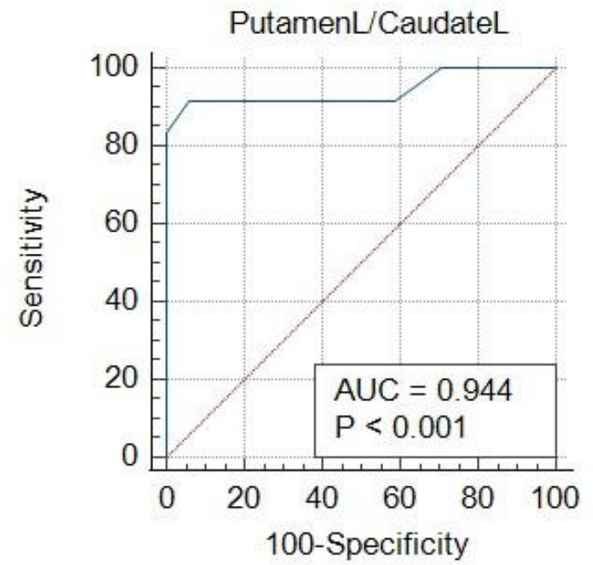
3. Results

ROC analysis demonstrated:







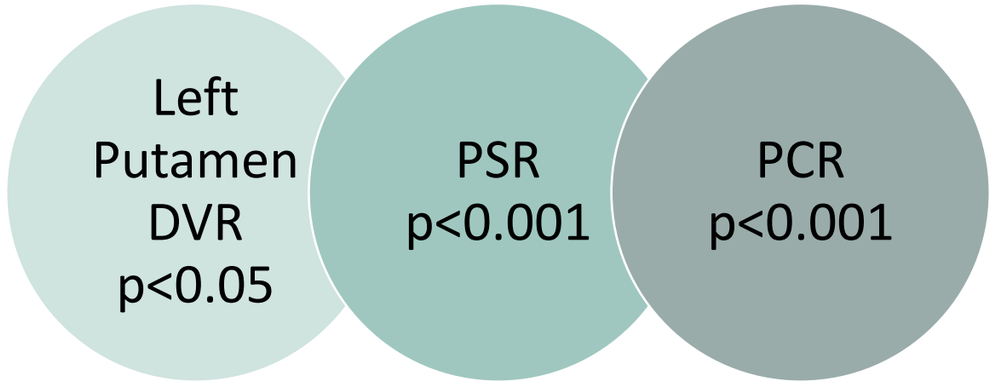


3. Results

- An accuracy of 58.6% and a κ-coefficient of 0.2 between the physician's diagnosis and the software's z-score classification were observed.

True Positive 9	False Positive 9
False Negative 3	True Negative 8

- Among the evaluated parameters, statistically significant differences between pathological and non-pathological mean values, exhibited:



4. Conclusions

- The z-score-based software classification showed limited agreement with the physician's diagnosis.
- However, parameters derived from left putamen DVRs may enable a differentiation between pathological and non-pathological cases, indicating their potential role in clinical decision making.
- Further standardization and optimization of these parameters are essential to enhance their accuracy and reliability, ultimately improving their clinical utility in supporting more precise and informed decision-making.

5. References

1. Koch W, Hamann C, Radau P, Tatsch K. Does combined imaging of the pre- and postsynaptic dopaminergic system increase the diagnostic accuracy in the differential diagnosis of parkinsonism? Eur J Nucl Med Mol Imaging. 2007;34(8):1265–73. doi: 10.1007/s00259-007-0375-8.

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3. Djang DSW, Janssen MJR, Bohnen N, Booij J, Henderson TA, Herholz K, et al. SNM practice guideline for dopamine transporter imaging with 123I-Ioflupane SPECT 1.0. J Nucl Med. 2012;53(1):154–63. doi: 10.2967/jnumed.111.100784.