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Case Study

^{123}I xSPECT Quant enables standardized quantification in unclear motion disorder

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Data courtesy of CHUV, Nuclear Medicine, Lausanne, Switzerland

History
Two patients were evaluated for unclear motion disorders not distinctly characterizable to a particular disease process upon clinical examination. The first was a 47-year-old female who was assessed for a tremor of the left upper limb and lower limb. The second patient was a 77-year-old male with tremors in the upper right limb persisting for almost two years with increased progression. ^{123}I Ioflupane SPECT/CT studies using xSPECT Quant™[1] technology were performed on both patients to determine striatal dopamine transporter (DaT) binding potential and evaluate tracer uptake.

Patient 1
Diagnosis
There is normal tracer uptake and symmetrical tracer distribution of both striatum, and of the caudate lobe and putamen of the female referred to as patient 1. (See Figure 1.)

xSPECT Quant, in combination with visual analysis, shows normal tracer uptake.

Conclusion
Patient 1 does not demonstrate disease-specific changes for Parkinson's disease and additional diagnostics are needed.

Patient 2
Diagnosis
Conversely, in the second patient the DaT scan images show pathologic uptake with deceased dopaminergic activity in bilateral striatal regions, predominant on the putamin, especially on the left side, which is consistent with Parkinson's Disease. (See Figure 1.)

Conclusion
The second patient shows typical decrease of the dopaminergic metabolism with high probability of Parkinson's disease. In addition to the visual read, xSPECT Quant using ^{123}I in DaT scan enables standardized quantification assessment, as shown in Figure 1.

Comments
SPECT/CT DaT scans can aid in evaluating unclear motion disorders caused by neurological disease. The striatum receives innervation by dopaminergic projections from the substantia nigra (SN). Here, the synapses are relasing the neurotransmitter dopamine in the synaptic gap where it has been uptaken by the dopamine receptors.

^{123}I Ioflupane binds to the presynaptic dopamine transporter, responsible for the reuptake of released dopamine by the neurosynapses. The degeneration of the presynaptic DaT can be pathognomonic for Parkinson's disease. The diagnosis of an abnormal scan can influence medical treatment more when it is abnormal, compared to when it is normal.[2]

The Society of Nuclear Medicine and Molecular Imaging (SNMMI) and the European Association of Nuclear Medicine (EANM) concur that the complexity of human conditions makes it impossible to always reach the most appropriate diagnosis or to predict with certainty a particular response to treatment.[3]

Looking to account for unique patient qualities and improve the quality of service to patients, Söederlund et al. has shown that a combined approach using visual assessment and semi-quantitative analysis of tracer binding created more reproducible clinical reporting of ^{123}I-FP-CIT SPECT studies. Also recommended was that physicians should have access to both striatal binding ratios (SBR) and caudate- to-putamen ratios (CPR) data to minimize inter-observer variability.[4] With the advent of xSPECT Quant for ^{123}I, the next logical step beyond ratio analysis is made. During the last couple of years, it has been shown that ratio

has improved reading and comparison in this examination.[4]

Built upon xSPECT™ technology, xSPECT Quant offers accuracy and reproducibility of <10% uncertainty in reference to NIST (National Institute of Standards and Technology), an external standard. Introducing xSPECT Quant potentially reduces interobserver variability by standardizing uptake values, which allows reliable disease detection and evaluation of therapy response across imaging centers, cameras and dose calibrators. With this, a new chapter is about to begin.

In research, it has been demonstrated, that using more detailed methodology and looking into finer details of metabolic changes in the course of the disease, does have an impact on early diagnosis and can improve detection.[5] ■

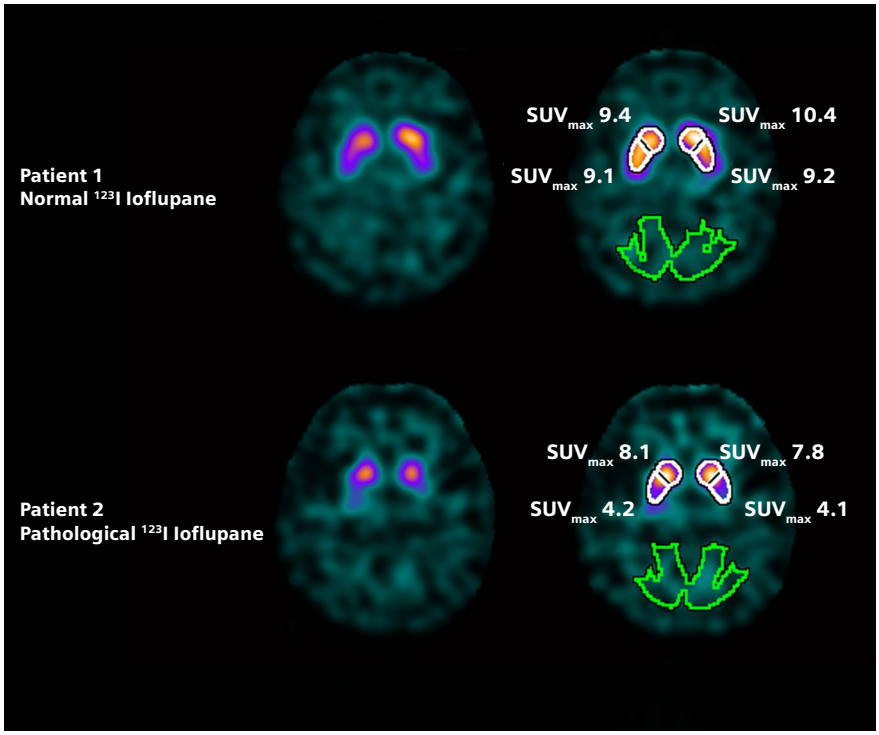

Figure 1: Studies compared normal and pathological tracer uptake in the caudate and putamen. Data courtesy of CHUV, Nuclear Medicine, Lausanne, Switzerland

References:

[1] Symbia Intevo, xSPECT and xSPECT Quant are not commercially available in all countries. Due to regulatory reasons, their future availability cannot be guaranteed. Please contact your local Siemens organization for further details.

[2] Oravivattanakul, S., Benchaya, L., Wu, G., Ahmed, A., Itin, I., Cooper, S., Gostkowski, M., Rudolph, J., Appleby, K., Sweeney, P. and Fernandez, H. H. (2016), Dopamine Transporter (DaT) Scan Utilization in a Movement Disorder Center. Mov Disord Clin Pract, 3: 31–35.

[3] J Nucl Med. 2012 Jan;53(1):154-63. doi: 10.2967/jnumed.111.100784. Epub (2011) Dec 8.

[4] Söderlund, TA et al., Value of semiquantitative analysis for clinical reporting of ^{123}I-2-β-carbomethoxy-3β-(4-iodophenyl)-N-(3-fluoropropyl) nortropane SPECT studies. J Nucl Med. (2013).

[5] Yokoyama, K. et al., Computed-tomography-guided anatomic standardization for quantitative assessment of dopamine transporter SPECT. European Journal of Nuclear Medicine and Molecular Imaging 44, 366–372 (2017).

Examination Protocol

Scanner: Symbia Intevo™[1] 16

SPECT		CT	
Injected dose Patient 1	5.2 mCi (195 MBq)	*Tube voltage*	110 kV
Patient 2	4.7 mCi (177 MBq)		
Scan delay	4 hours	*Tube current*	12 mAs
Acquisition	15 min	*Slice collimation*	0.5 mm
		Slice thickness	3.0 mm

The customer situation described herein is based on results that were achieved in the customer's unique setting. Since there is no "typical" hospital and many variables exist (e.g., hospital size, case mix, level of IT adoption) there can be no guarantee that other customers will achieve the same results.

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