**Brain SPECT Imaging with DaTscan (Ioflupane I-123 Injection)**

**Primary Indications:**
DaTscan is a radiopharmaceutical indicated for striated dopamine transporter visualization using single photon emission computed tomography (SPECT) brain imaging to assist in the evaluation of patients with suspected Parkinsonian syndromes (PS). In these patients, DaTscan may be used to help differentiate essential tremor from tremor due to PS (idiopathic Parkinson’s disease, multiple system atrophy and progressive supranuclear palsy). DaTscan is an adjunct to other diagnostic evaluations.

**Rationale:**
I-123 ioflupane is a structural analogue of cocaine with a high affinity for monoamine transporters, including the dopamine transporter (DAT), and is useful for SPECT imaging of the striatal DAT in the brain. The DAT is present in high density in the presynaptic terminals of dopaminergic neurons in the striatum (putamen and caudate nuclei) and serves as a marker for neuronal integrity. Loss of dopaminergic neurons in the substantia nigra of the midbrain is a central feature of the various PS and leads to loss of dopaminergic projection neurons to the striatum (the nigrostriatal pathway). This loss of DAT binding sites can be visualized with ioflupane SPECT. In contrast, essential tremor is a movement disorder characterized by bilateral postural or kinetic tremor typically most pronounced in the hands but without significant loss of dopaminergic neurons. The clinical distinction of essential tremor from PS is important because of differences in prognosis and therapy. Loss of striatal uptake of I-123 ioflupane
has also been reported in dementia with Lewy bodies (DLB).

I-123 Ioflupane SPECT studies typically show normal striatal tracer uptake in patients with essential tremor but reduced uptake in patients with PS due to loss of DAT binding sites. There are three (3) typical abnormal tracer uptake patterns seen in PS:

1) Asymmetrically decreased or absent activity in one putamen compared to the other; 2) absent activity in both putamens with visualization of the caudate nuclei, which may demonstrate unilaterally or bilaterally reduced activity; 3) absent activity in both putamens and markedly reduced activity in both caudate nuclei.

**Interfering conditions:** A number of medications and drugs of abuse can alter striatal uptake of I-123 Ioflupane. In particular, drugs that bind with high affinity to the DAT may compete with ioflupane for binding in the striatum and lead to decreased striatal activity. Potentially interfering drugs include:

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<td>Amoxapine</td>
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<td>Benztrpine</td>
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<td>Bupropion</td>
<td>Buspirone</td>
<td>Cocaine</td>
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<td>Mazindol</td>
<td>Methamphetamine</td>
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<td>Norephedrine</td>
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<td>Selegiline</td>
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<td>Modafinil</td>
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<td>Clomipramine</td>
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<td>Epinephrine</td>
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Contraindications: DaTscan is contraindicated in patients with known hypersensitivity to the active substance or any of the excipients, or to iodine and those who are pregnant.

Precautions: Patients with neurologic deficits or dementia must be closely monitored during SPECT imaging. If sedation is required to perform the study, it should be given after administration of the radiopharmaceutical.

Radiopharmaceutical: I-123 ioflupane is a federally controlled DEA Schedule II (CII) substance.
DaTscan is the formulation of I-123 ioflupane supplied by GE Healthcare and is a sterile solution for intravenous injection, in 2.5 mL of sterile solution in a single-use vial (2 mCi) / mL at calibration time.

Adult Dosage: 3 - 5 mCi

Pediatric Dosage: Not indicated for use in children

Radiation Dosimetry: Adult 5 mCi: critical organ (Urinary bladder wall) 1.0 rad;
Effective dose is 3.94 mSv in an adult.
**Route of Administration:**

I-123 ioflupane (DaTscan) is an intravenous injection and should be used without dilution. The radiopharmaceutical is injected as a slow bolus over approximately 20 seconds followed by normal saline solution to flush the intravenous line.

**Appropriate thyroid blocking treatment must be given before Injection of I-123 Ioflupane.** Potassium Iodide Oral Solution or Lugol’s Solution (equivalent to 100 mg iodide) or potassium perchlorate (400mg) to block uptake of iodine 123 by the patient’s thyroid. **Administer the blocking agent at least one (1) hour before the dose of DaTscan.**

**Patient Scheduling:**

Requests for the I-123 DaTscan brain imaging should be submitted by the referring physician and approved by the attending nuclear medicine physician. At the time of scheduling, arrangements should be made with the referring physician regarding the patients (1) Withdrawal of interfering medications and avoidance of those between the time of scheduling and the day of the scan; (2) if necessary, beta – HCG testing; and (3) arrangements for sedation if necessary.

DaTscan is available four (4) days a week. Delivery requires six (6) days from the day of order.

DEA regulatory requirements must be met when handling a Schedule II (CII) substance. After approval of the request for a Study the LSUHSC Pharmacy is called to: **1.** Place the order for the radiopharmaceutical with the distributor and **2.** Coordinate their availability to receive the dose when delivered. After the radiopharmaceutical is delivered to the pharmacy and received
by an authorized pharmacist, who will complete the appropriate
DEA acceptance form. The drug will be transferred to the Nuclear
Medicine department.

After dispensing the radiopharmaceutical, used vials and syringes
May be disposed of as combined (Tl-201, Ga-67, In-111, I-123)
radioactive material waste.

If the I-123 Ioflupane vial or dose is **NOT** administered to the
patient for any reason it will be tracked in the Nuclear Medicine
Dose Management Computer (NMIS) system and held for decay in
the lock cabinet in the Radiopharmaceutical Laboratory. After the
I-123 has decayed and this is documented by appropriate counting
with a survey meter, the Pharmacy is called to retrieve the drug to
dispose of it properly.

**Patient Preparation:**

**Hydrate:** To minimize radiation dose to the bladder, advise the
patient to hydrate before and after the I-123 ioflupane is
administered to permit frequent voiding.

**Pretreatment with SSKI: to Block uptake of any free I-123
iodide by the patient’s thyroid gland,** the patient should receive
SSKI (saturated solution of potassium iodide) at least 60 minutes
before tracer is administered. The adult dosage of SSKI is 2 drops
P.O. in a glass of water.

**Equipment Setup:**

Gamma camera: Dual-head LFOV SPECT using a circular 360°
orbit with a rotation radius of 13 cm (11 – 15 cm is acceptable) to
maintain the detectors as close to the patient’s head as possible.

Images should be acquired in a 128 x 128 matrix at 30 – 40
seconds per stop for 120 stops (3° per stop) step and shoot. The recommended total acquired counts is a minimum of 1.5 million.

**Collimator:** Low-energy high-resolution
**Energy window:** 159 keV with a ± 10 % energy window
**Zoom:** Sufficient for 3.5 mm to 4.5 mm pixel size

**Patient Positioning:**

The patient should be encouraged to void prior to the acquisition. The patient is placed in the supine position with the head centered and as straight as possible. The head rests in a cushioned plastic head holder and is positioned so that the orbito-meatal line is perpendicular to the axis of rotation. It is important to keep the sagittal plane of the head perpendicular to minimize lateral head tilt. The patient must be positioned so that he/she will be able to remain motionless for the SPECT acquisition. Arm boards, positioning wedges, and support straps must be used effectively to eliminate any patient discomfort.

Every effort should be made to achieve the 13 cm patient-to-detector distance for the SPECT acquisition. Rotate the detectors around the patient’s head to verify that the scanner orbit does not cause the detectors to collide with the shoulders.

**Procedure:**

Confirm that the patient has been hydrated and given the potassium iodide, as noted above. The venous line is placed and/or tested for patency when the patient arrives in the department. The injection of the radiopharmaceutical is performed by a staff nuclear medicine physician or his/her designee. If sedation is needed for imaging, sedation should not be initiated until just before imaging.
SPECT image acquisition may begin 3 – 6 hours following the injection of the I-123 ioflupane. The patient should be made as comfortable as possible in order to minimize patient movement. Always check the acquired image for motion artifacts immediately after the study, before the patient leaves. If artifacts are noted, repeat image acquisition no later than six-hours post-injection.

**Image Processing:**

**Reconstruction algorithm:** use Filtered Back Projection (FBP) or iterative reconstruction (eg, OSEM)

**Filtering (pre-2D or post-3D):** Butterworth (or other low-pass linear filter)

**Filter power factor:** 8-10 (system-dependent; please consult with GE Healthcare Applications Specialist)

**Cut-off:** Changing the filter cutoff will affect image resolution. 0.5 to 0.6 cycles per cm nominally (or as appropriate to achieve Approximately the same level of smoothing as the images shown in the guide book)

**Attenuation correction:** Not necessary. If desired, can use Chang (also known as linear or zero-order)

**Attenuation correction coefficient (if used):** a locally calculated AC coefficient from a phantom measurement should be used if available. Otherwise, use a nominal value of 0.11 cm.

**Background subtraction:** No background subtraction

**Pixel (voxel) size:** 3.5 mm to 4.5 mm isotropic

**Presentation:** Transaxial (transverse) slices parallel to the anterior commissure-posterior commissure (AC-PC) line with single pixel thickness
**Color scale:** The preferred option for displaying images is the “cool” color scale

The nuclear medicine physician need to review the images before the patient is released from the nuclear medicine department.

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