Overview

Metaiodobenzylguanidine (MIBG) is an analog of norepinephrine and is taken up by the adrenergic nervous system of tissues that are derived from the neural crest. The Neuroectodermal/Norepinephrine Study is used primarily to image tumors that arise from the neural crest.

Indications

Identification and localization of tumors of neuroectodermal tissues (1):
1. Benign and malignant, intraadrenal and extraadrenal pheochromocytomas (2,3).
2. Neuroblastomas (4,5).
3. Carcinoid tumors (6).
4. Medullary thyroid tumors (7).
5. Paragangliomas (8).
6. Chemodectomas (9).
7. Evaluation of myocardial norepinephrine receptors (10).

*Exams ordered for indications which are not listed above need to be discussed with the Nuclear Medicine Physician.

Examination Time

Initially: 15 minutes for injection of the radiopharmaceutical.

Delayed images at 48 and 72 hours: 1 hour for standard planar images. (Additional delayed images may be necessary.)

Patient Instructions / Scheduling

Consider Octreoscan as an alternative. Consult nuclear medicine physician before scheduling patient.

1. Instruction to Patients:
   a. The Nuclear Medicine physician must review the records or speak with the referring physician prior to scheduling to confirm the indications for I-131 MIBG scintigraphy. Also, patient’s sensitivity to iodine must be known.
b. The patient is to get a prescription for SSKI (Iodine) from his/her Physician prior to the exam.

SSKI – 0.3 ml dropper bottle
1 gm/ml
0.6 ml = 600 mg
Graduated dropper in 0.3 and 0.6 ml

Note: For dosage, see next page.

c. Females of child-bearing age should be notified that if there is any chance that they are pregnant, the test should not be initiated.

d. Notify the patient that on Day 1 he/she will receive an injection and that imaging will be performed at 48 hours, with possible return for further imaging at 72 hours. There may be additional imaging sessions scheduled, depending upon the findings. Be sure they understand that the imaging will require two to three hours of time.

e. On the second or third imaging day, an additional injection may be required to localize the kidneys.

f. There are certain medications and substances that will interfere with the uptake of I-131 MIBG (see attached). The patient should therefore bring in a complete list of all medications currently being used. Ideally, the patient or the referring physician could be questioned over the phone prior to scheduling.

Lab / Imaging Correlation

Request from the referring physician’s office, if available, the results of plasma concentrations of metanephrines, norepinephrine, epinephrine, or urinary assays of vanillylmandelic acid (VMA), metanephrines, and catecholamines. The nuclear medicine physician may require these before proceeding.

Computerized tomography, ultrasonography, and/or MRI of the abdomen probably has been performed recently. Please be sure that the images and/or reports are available to the nuclear medicine physician. If the patient has neuroblastoma, a bone scan should be obtained initially. This will be determined on the initial visit of the patient.

Patient Preparation

Drugs to be avoided prior to study (trade names in parenthesis) (2,11-13):
1. Tricyclic antidepressants and related drugs - should avoid for 6 weeks prior to the study:
   a) amitriptyline & derivatives (Elavil, Endep, Etrafon, Triavil, Amitril, Emitrip, Enovil).
   b) amoxapin (Asendin).
   c) loxapin.
   d) doxepin (Adapin, Sinequan).
   e) imipramine & derivatives (Tofranil, Imavate, Janimine, Presamine, SK-Pramine, Tipramine).

2. Anti-hypertensives - should avoid for 2 weeks prior to the study:
   a) labetalol (Normodyne, Trandate).
   b) calcium channel blockers.
   c) reserpine (Serpasil, Sandril).

3. Sympathetic-amines - should avoid for 2 weeks prior to the study:
   a) pseudoephedrine (Halofed, Sudafed, Sudrin, others).
   b) phenylpropanolamine HCL (Propagest, Sucrets Cold Decongestant, Entex, others).
   c) phenylephrine HCL (Neo-Synephrine, Alconefrin, Rhinail, others).
   d) ephedrine.

4. Cocaine - should avoid at all times and for 2 weeks prior to the study.

Before scanning, thyroidal uptake of free (unbound) radioiodine is blocked by administration of SSKI (0.3 ml = 300 mg po TID) with milk or food (total 8 days), starting one day before I-131 MIBG injection and six days after injection (if patient has renal disease, decrease to 0.3 ml daily). The referring physician can write the Rx. (2)

Remove all metal objects and prostheses before imaging. Because urinary bladder is normally seen, the patient should void just prior to imaging. Significant colonic activity can be seen in 15% of patients. If there is extensive colonic activity seen on the first day of scanning, the nuclear medicine physician may suggest a cathartic to be taken prior to imaging the second day.

a. Magnesium citrate, 1 bottle - 8 oz, orally. Drink entire contents the night before imaging. DO NOT ADMINISTER TO PATIENTS WITH RENAL DISEASE.

Or

b. Fleet Phospho-Soda.

**Equipment & Energy Windows**

Gamma camera: Large field of view.
Collimator: High energy, parallel hole.

Energy window: 20% window centered at 364 keV.

Matrix 128x128

**Radiopharmaceutical, Dose, & Technique of Administration**

Radiopharmaceutical:
I-131-metaiodobenzyguanidine (I-131-MIBG).

Dose:
I-131-MIBG: 500uCi (18.5 MBq) (2,8,16).

Technique of administration: Intravenous injection over 30 seconds (2).

**Patient Position & Imaging Field**

Patient position: Supine.

Imaging field: Neck, chest, abdomen, and pelvis.

**Acquisition Protocol**

At 48 and 72 hours acquire ANT and POST images from head to pelvis (3,15):
*For imaging of neural crest tumors (neuroblastoma), total body scintigraphy should be performed.

Each image should be acquired for 100,000 counts or 20 minutes, whichever occurs first. On the second or third day, DTPA may be injected (5-10 mCi) and the images of the kidneys obtained for localization. This would be specifically requested by the nuclear medicine physician after a review of the images. SPECT may be requested.

Place markers on patient, turn off H2, place CO57 flood source on top of head 2, and scan patient on CO57 isotope for 60 sec. per stop.

Obtain marker views (with technetium markers) to overlay for localization.

a. Head and chest: chin, shoulders, SSN, xiphoid.

b. Abdomen and pelvis, anterior superior iliac crest ("hips"), symphysis pubis, umbilicus.
Data Processing

For SPECT images use the Xeleris and follow processing protocol.

Optional Maneuvers

SPECT images (17):
1. Degrees of rotation: 360°.
2. Number of images: 64.
3. Time per image: 20 seconds.

Principle Radiation Emission Data - I-131 (21)

Physical half-life = 8.04 days.

<table>
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<tr>
<th>Radiation</th>
<th>Mean % per disintegration</th>
<th>Mean energy (keV)</th>
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<tbody>
<tr>
<td>Beta-4</td>
<td>89.4</td>
<td>191.5</td>
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<tr>
<td>Gamma-14</td>
<td>81.2</td>
<td>364.5</td>
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</tbody>
</table>

Dosimetry - I-131-MIBG (22)

<table>
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<tr>
<th>Organ</th>
<th>rads/500 µCi</th>
<th>mGy/111 MBq</th>
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<tbody>
<tr>
<td>Adrenal medulla</td>
<td>50.00</td>
<td>500.0</td>
</tr>
<tr>
<td>Thyroid (unblocked)</td>
<td>17.50</td>
<td>175.0</td>
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<tr>
<td>Heart wall</td>
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<tr>
<td>Spleen</td>
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<tr>
<td>Ovaries</td>
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<tr>
<td>Liver</td>
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<tr>
<td>Total body</td>
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<td>0.5</td>
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References


Normal Findings


Note: This procedure has not yet been reviewed by the Society of Nuclear Medicine procedure guideline development process.