CISTERNOGRAPHY
3.2
Clearwater Imaging Associates Protocol

Overview

Cisternography depicts the flow of cerebrospinal fluid along normal and abnormal pathways following injection of the tracer into the lumbar intrathecal space.

Indications

Diagnosis of normal pressure hydrocephalus: Dementia, Gait disorder, Urinary incontinence (1).

Identification of cerebrospinal fluid (CSF) leaks: Trauma, Otorrhea, CSF Rhinorrhea (2,3).

Evaluation of lumboperitoneal shunts (4).

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

Examination Time

Initial lumbar puncture and imaging: 45 minutes.

Delayed images at 24 and 48 hours: 30 minutes for each set of images.

Patient Instructions

Schedule this test in the morning, because of the need for possible imaging 2-6 hours post injection. Noon start times are O.K. if referring physician’s schedule requires.

Scheduling

Notify the referring physician that he or his consultant will be requested to perform a lumbar puncture for administration of the radiopharmaceutical, and schedule with them. Lumbar puncture is not performed by the Nuclear Medicine physicians.

Notify the Hot Lab technologist as soon as this test is scheduled, since the radiopharmaceutical used is not routinely available in the pharmacy. 48 hour notice is required.

If the study is being performed because a CSF leak is suspected, request that the referring physician, or someone of his choice, be present to insert, and
subsequently remove, nasal packing on the day of study. Nasal packing should be inserted before tracer administration.

**Patient Preparation**

Informed consent must be obtained for the lumbar puncture. This will be done by the physician performing the lumbar puncture.

If possible, the patient should have no diagnostic lumbar punctures within three to six days of the procedure.

**Equipment & Energy Windows**

Camera: Large field of view gamma camera.

Collimator: Medium energy, parallel hole.

Energy windows: 20% windows centered at 173 and 247 keV.

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

Radiopharmaceutical: In-111-DTPA (diethylenetriaminepentaacetic acid) (4,5).

Dose: 0.5 mCi (18.5 MBq).

Technique of administration:
1. Intrathecal via lumbar puncture (performed by physician).
2. 22 gauge or smaller needle preferred to minimize CSF leakage.
3. May use 3 way stopcock so that injection of radiopharmaceutical can be followed by 1-2 ml sterile water flush.
4. Following lumbar puncture ask physician for any special instructions.

**Patient Position & Imaging Field**

Patient position:
1. Supine for ANT and L LAT images.
2. Prone for 2-6 hour POST image of lumbar spine.

Imaging field:
1. Entire head for all sets of images.
2. Lumbar spine for immediate post injection image.

**Acquisition Protocol**

Acquire a POST lumbar spine image at 2-6 hours (Only if requested by the Physician performing the injection).
Acquire ANT, R and L LAT images at 24 and 48 hours.
1. For the ANT image the orbitomeatal line should be perpendicular to the collimator face.
2. For the R and L LAT image the head may be slightly rotated so that the side of the head is flush with the collimator.
3. If at 2 hours there are very few counts coming from the head, show the 2 hour image to the nuclear medicine physician to determine if the injection extravasated outside of the subarachnoid space. If there has been extravasation, the study is usually terminated.
4. Acquire 8 minute images. Subsequent images should be made for the same time at the same intensity (on the same camera), if possible, when images are taken. Transmission images of each view are acquired at 48 hours.
5. Patients with shunts require a 24 and 48 hour images of the chest and abdomen.

**Quantitative diagnosis of CSF rhinorrhea:**
1. 2 hours after intrathecal injection of the radiopharmaceutical, anterior and posterior pledgets are placed in each nostril by an ear, nose, & throat physician.
2. Each pledget is approximately 1 cm square, has an absorptive capacity of 0.5 mL of water, has a string attached to it for retrieval, and has a label on the protruding portion of the string indicating its position, e.g. left-anterior.
3. 4 hours after placement (6 hours after injection of the radiopharmaceutical), the pledgets are removed.
4. 5 mL of venous blood is withdrawn into a heparinized tube both at time of placement and at the time of removal of the pledgets.
5. 0.5 mL of plasma is withdrawn from each blood sample following centrifugation.
6. The radioactivity in each pledget and each 0.5 mL plasma sample is measured in a well counter using a 150-250 keV energy window.
7. The results are expressed as the ratio of pledget radioactivity over the average plasma radioactivity.
8. Normal pledget to plasma radioactivity ratios do not exceed 1.3.

When imaging for CSF leaks:
1. Obtain ANT, POST, L LAT, and R LAT images.
2. Position the patient in the position that maximizes the leak:
   a) An absorbent sheet of paper should be placed underneath the patient's nose to catch any radioactive rhinorrhea.
3. An ANT image of the abdomen may be added to look for swallowed radioactive CSF in the intestine.
4. Tomography may increase the sensitivity of imaging for CSF leaks.

**Data Processing**
None.

**Principle Radiation Emission Data - In-111** (9)

Physical half-life = 2.83 days.

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<th>Radiation</th>
<th>Mean % per disintegration</th>
<th>Mean energy (keV)</th>
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<td>Gamma-3</td>
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**Dosimetry - In-111-DTPA** (10)

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<th>mGy/55.5 MBq</th>
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**References**


Normal Findings


Note: Standards have not been published by SNM or ACR.