

VENTRICULAR SHUNT STUDY (Tc-99m-DTPA)

Overview

- The Ventricular Shunt Study evaluates the patency of shunts by direct injection of the radiopharmaceutical into the shunt apparatus.

Indications

- Evaluation of cerebral ventricular shunt patency (1-3).

Examination Time

- 1 hour or more depending on whether the shunt is patent.

Patient Preparation

- Shave the hair over the shunt reservoir.

Equipment & Energy Windows

- Gamma camera: Large field of view; may use small field of view.
- Collimator: Low energy, high resolution, parallel hole.
- Energy window: 20% window centered at 140 keV.

Radiopharmaceutical, Dose, & Technique of Administration

- Radiopharmaceutical: Tc-99m-DTPA (diethylenetriaminepentaacetic acid) (3).
- Dose: 1 mCi (37 MBq) in a small volume, e.g. 0.1 mL or less (4).
- Technique of administration: Usually into shunt reservoir; the exact technique depends on the type of shunt (5). The injection is performed by the neurosurgeon or nuclear medicine physician (1-3).

Patient Position & Imaging Field

- Patient position: Supine.
- Imaging field: Head and shunt pathway; may include neck and chest or neck, chest, and abdomen.

Acquisition Protocol

- Acquire ANT images of head and entire distal length of shunt tubing immediately after injection and at 5, 10, and 20 minutes:
 1. Acquire each image for 1 minute.
 2. Expose the images so that background activity is just visible.
- Timing of delayed images, if any, will depend on the findings in the initial images. Show the images through 20 minutes to the nuclear medicine physician.

Protocol Summary Diagram



Data Processing

- None.

Optional Maneuvers

- Images in other projections: LAT images may be obtained to better define tracer position within the cranium.
- Quantitation of CSF flow: The flow of cerebrospinal fluid through the reservoir may be quantitated (4,5).
- Evaluation of other shunts: Flow in other shunt or drug delivery systems can be evaluated using the same techniques (6).

Principle Radiation Emission Data - Tc-99m (7)

- Physical half-life = 6.01 hours.

Radiation	Mean % per disintegration	Mean energy (keV)
Gamma-2	89.07	140.5

Dosimetry

- Dosimetry will vary greatly with the pathway of shunt tubing and degree of obstruction.

References

1. James AE, DeBlanc HJ, DeLand FH, et al: Refinements in cerebrospinal fluid diversionary shunt evaluation by cisternography. Am J Roentgenol 115:766-773, 1972.
2. Gilday DL, Kellam J: In-111-DTPA evaluation of CSF diversionary shunts in children. J Nucl Med 14:920-923, 1973.
3. Sty JR, D'Souza BJ, Daniels D: Nuclear anatomy of diversionary central nervous system shunts in children. Clin Nucl Med 3:271-275, 1978.
4. Chervu S, Chervu LR, Vallabhajosyula B, et al: Quantitative evaluation of cerebrospinal fluid shunt flow. J Nucl Med 25:91-95, 1984.
5. Hidaka M, Matsumae M, Ito K, et al: Dynamic measurement of the flow rate in cerebrospinal fluid shunts in hydrocephalic patients. Eur J Nucl Med 28:888-893, 2001.
6. Schmidt E, Oates E: In-111-DTPA to evaluate the patency of an implanted intrathecal infusion pump. Clin Nucl Med 22:768-770, 1997.
7. 43-Tc-99m: In MIRD: Radionuclide Data and Decay Schemes, DA Weber, KF Eckerman, AT Dillman, JC Ryman, eds, Society of Nuclear Medicine, New York, 1989, pp 178-179.

Normal Findings

- > Harbert J, Haddad D, McCullough D: Quantitation of cerebrospinal fluid shunt flow. J Nucl Med 112:379-387, 1974.
- > Chervu S, Chervu LR, Vallabhajosyula B, et al: Quantitative evaluation of cerebrospinal fluid shunt flow. J Nucl Med 25:91-95, 1984.