

CSF SHUNT EVALUATION
UPDATED: Dec 2011

CPT CODE: 78645

Indications:

- To test for patency of ventriculoperitoneal or ventriculoatrial shunt
- To test for distribution of chemotherapeutic drug when injection is via V-P reservoir

Patient Prep:

This study is coordinated with neurosurgical resident or staff who obtains and documents verbal consent, accompanies the patient to NM, then inserts the needle into the shunt reservoir under aseptic conditions. A Nuclear Medicine Physician or resident should also be present to help as necessary with protocol and to inject the tracer. The X-ray package with shunt series and CT's should be available at the time of the tracer instillation.

Scheduling:

The study takes about one hour, and various delayed images (2-6 hours) may be required. The necessity of delayed imaging cannot be determined until the early study is obtained.

Radiopharmaceutical

& Dose: 0.4-0.6 mCi in 0.3-0.5 ml $^{99m}\text{TcO}_4$ (pertechnetate); activity in the smallest possible volume is desirable.

FLUSH: A 0.9% Sodium Chloride flush is used in this procedure. This should be drawn from a freshly opened bag of 0.9% Sodium Chloride solution. Both the opening of the bag and drawing up of the flush should be done in the Laminar flow hood. Sometimes the neurosurgery fellow will prefer to use CSF he/she has aspirated from the patient to inject and flush the tracer. See *alternative procedure*.

Imaging Device:

GE with LEHRPH collimator.

Imaging Procedure:

Predefined Study: CSF SHUNT_ACQ. Use this protocol exactly.

- When needle is in place, position patient under camera (in lateral or anterior position depending on placement of shunt). Make sure the entire head is in the field of view. Most times the distal side of the tubing is occluded manually while the tracer is injected. Start the gamma camera and obtain 10-second images. At the count of five, inject the tracer. After about 30 seconds, release the distal occlusion.
- Immediately post flow obtain a 2-minute picture in same position. Record counts.
- Obtain 2-minute image of orthogonal view to that obtained above. Record counts.
- Obtain a 2-minute chest image. Mark sternal notch and xiphoid. Record counts.
- Obtain a 2-minute abdominal image - mark xiphoid and pubic bone. Record counts.
- Follow with a second series of images at 20 minutes post injection. Record counts.
- Do not pump tubing or do any intervention before this. If some flow occurs consider sitting or mobilizing patient, pumping tubing, then repeating images.
- Follow with a third series of identical images at 2-6 hours post injection if necessary (with rolling or walking patient between studies), or repeat entire injection and imaging process as directed by NM physician.
- A repeat injection procedure is required if only one side of valved reservoir is visualized. Manipulation of the needle is required to place it on the opposite side of the diaphragm from the first injection series.
- If the distal tubing is partially visualized but no abdominal activity is seen then the physician may request an image while pumping in lieu of reinjection. This can be set up as static images or a flow study.

Display: Predefined Study: CSFSHUNTDISP. The intent is to obtain all images on one sheet: the flow images, immediate and delayed images. If a second injection is required then all of these images are to be displayed separate from the first injection.

Interpretation: The shunt can occlude at either the proximal (ventricular) or distal (atrial or peritoneal) ends. Therefore, during the flow study (injection of tracer) note should be made if the tubing is occluded distal to reservoir (encouraging flow proximally into ventricles) and flow should be followed as this pressure is released (to observe distal flow). If a reservoir has a flap valve then sometimes the needle may be distal to this, so the proximal site is not tested - a repeat injection can be performed with the needle further advanced. (However, if CSF was easily withdrawn then this might indicate proximal patency). If the first study shows only the proximal side then the needle can be withdrawn slightly and no attempt made to occlude tubing when the repeat injection is performed.

Obstruction usually occurs at the ventricular and abdominal ends of the shunt, with the abdominal possible end being more common. Sometimes the tubing can kink or break at other sites. There may be location of tracer about the abdominal end of the catheter without free dispersal through the abdominal cavity. This can mimic normal flow except there is not free dispersal of tracer through the peritoneal cavity, and this occurs with loculation about the distal end of the catheter. In this instance free flow of tracer is encouraged by walking or moving the patient about (rolling patient from side to side). In this instance an US study should be performed to identify possible loculated site.

When this study is used to determine distribution of a drug injected into a reservoir then the identical procedure to the usual drug injection technique should be employed (same routine exactly with the same flush volume).

Invasive Procedure: This procedure is minimally invasive but the invasive portion of the procedure is performed by our neurosurgical colleagues. This remains in their purview entirely.

ALTERNATIVE PROCEDURE:

Indications: When the physiology of the system is in question, i.e. is the flow rate adequate to remove CSF from the ventricles.

Preparation: The patient must be flat for 2 hours prior to the test so that the CSF flow is in equilibrium.

Method: Using a 25 g needle attached directly to the syringe of tracer, inject carefully the smallest volume into the reservoir but do not flush. Image constantly (1-minute images) for 30 minutes and evaluate half washout time (normal ~20 minutes).

Interpretation: A washout curve is calculated.

Comments: A Nuclear Medicine staff physician or resident will determine when the study is complete.

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