Renal Transplant Scintigraphy

**Primary Indications:** Evaluation of renal transplant perfusion and function; differentiation of parenchymal causes of transplant dysfunction (acute tubular necrosis, rejection) from mechanical causes (obstruction, vascular compromise); and detection of urine leaks.

**Rationale:** The radiopharmaceutical is accumulated by the kidney (by glomerular filtration in the case of Tc-99m DTPA and chiefly by tubular secretion in the case of Tc-99m MAG3) and is excreted into the renal collecting system.

**Interfering Conditions:** Severe renal transplant dysfunction (e.g., in oliguric/anuric patients, those requiring dialysis or those with serum creatinine concentrations >6 mg/dL) will limit the utility of the study. Uptake of Tc-99m DTPA will likely be decreased in patients with serum creatinine concentrations >2.5 mg/dL; consult with physician to aid in the choice of Tc-99m DTPA vs. Tc-99m MAG3 under these circumstances.

**Precautions** Radiation dose will be minimized by encouraging fluid intake (if allowed by the patient’s condition) and by frequent voiding after the procedure. Check with patient and/or review patient’s chart to determine if patient’s fluid intake is being restricted. If so, consult with physician.

**Radiopharmaceutical:** Tc-99m Mertiatide (Tc-99m MAG3) is the preferred radiopharmaceutical. Tc-99m Pentetate (Tc-99m DTPA) may be substituted (after discussion with the physician) for on-call procedures or on days when only one renal imaging procedure is anticipated (e.g., Saturday). See above (Interfering Conditions).

**Adult Dosage:** Tc-99m MAG3: 7.5 mCi
Tc-99m DTPA: 15 mCi

**Pediatric Dosage:** Tc-99m MAG3: 100 μCi/kg with a minimum dosage of 1.0 mCi.
Tc-99m DTPA: 210 μCi/kg with a minimum dosage of 2.0 mCi

**Radiation Dosimetry:** Tc-99m MAG3
Adult. Critical organ (bladder wall): 3.05 rem. Effective dose: 0.20 rem.
Infant (1-year). Critical organ (bladder wall): 1.18 rem. Effective dose: 0.08 rem.

Tc-99m DTPA
Adult. Critical organ (bladder wall): 3.61 rem. Effective dose: 0.35 rem.

(Dosimetry is altered in the setting of impaired renal function. For example, in renal failure, gastrointestinal tract doses are increased, although effective dose is slightly decreased. With acute obstruction, the dose to the kidney is substantially increased.)

**Route of Administration:** Intravenous

**Patient Preparation:** The patient should be well hydrated for the examination. Unless otherwise specified by the physician, the patient is to be hydrated prior to starting the study with approximately 16 ounces (500 mL) of
water orally (for a 70-kg adult). If this is not possible, the patient should be hydrated using intravenous fluids. Adults should be hydrated with 500 mL of normal saline infused intravenously over 30 minutes starting 15 minutes prior to radiopharmaceutical administration. For children weighing more than 35 kg, 500 mL 5% dextrose/0.5 normal saline solution should be infused intravenously over 30 minutes starting 15 minutes prior to radiopharmaceutical administration. Smaller children should receive appropriate hydration based on body weight, using 5% dextrose/0.5 normal saline solution at a dosage of 0.5 mL/kg/min (maximum 500 mL) infused over 30 minutes starting 15 minutes prior to radiopharmaceutical administration. The patient should void immediately prior to the study.

**Equipment Setup:** Gamma Camera: LFOV camera for studies in adults with zoom; SFOV or zoomed LFOV camera for studies in small children.
Collimator: LEAP for studies in adults. For studies on the portable camera, a diverging collimator should be used for adults and a LEAP or converging collimator for small children or infants.
Gamma camera detector below imaging table to allow for posterior imaging for conventional studies; see below.
Energy Window: 140 keV with 20% window

**Patient Positioning:** Supine for anterior imaging. The field of view should include the kidney and the bladder. If possible, urinary drainage bags and surgical drainage bags should also be included at the edge of the imaging field.

**Procedure:** The radiopharmaceutical is injected as a bolus with a radionuclide angiogram setup, and the radionuclide angiogram is acquired. Observe the persistence scope and, if needed, shift the camera position during the flow study in order to position the transplant kidney in the upper half of the field of view. Immediately following the radionuclide angiogram, sequential images are obtained for a total of 20 minutes of imaging. If possible, the patient should then get up from the imaging table (to allow gravity to aid in renal drainage) and void (to decrease bladder pressure). An anterior supine post-void image is then obtained. For catheterized patients, an image of the drainage bag positioned next to the patient’s thigh should be obtained. Similar images should be obtained of any surgical drainage bags. Further images, possibly including a diuretic study, may be obtained at the request of the physician. Additional delayed images are often necessary for evaluation of a suspected urine leak.
Radionuclide angiogram

Film using Display, Renal Flow or "D" display (Discrete image-by-image scaling) if not using preset formatting

30 x 2-sec images, 128 x 128 matrix word mode

Sequential images

Film using Display, Renal Function or "U" display (Uniform scaling) if not using preset formatting

57 x 20-sec images, 128 x 128 matrix word mode

Post-void image

1 x 2-min image

1 x 2-min image, 256 x 256 matrix word-mode

Items Required For Complete Study:

1. **Radionuclide angiogram and sequential images**: Film using Display, Renal Flow and Renal Function. If not using the preset formatting, a “D” display (Discrete image-by-image scaling) should be used for the radionuclide angiogram and a “U” display (Uniform scaling) should be used for the sequential images.

2. **Post-void image**.

3. **Transfer of all digital images to work station**: processing will be performed by a physician.