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Diagnosis of Renovascular Hypertension

Renovascular hypertension is defined as an elevated blood pressure caused by renal hypoperfusion, usually resulting from anatomic stenosis of the renal artery. This disease is estimated to affect only a small percentage of all patients with hypertension, but a large number of patients with high blood pressure that is difficult to treat. Patients are commonly diagnosed after developing abrupt or severe hypertension, hypertension resistant to 3-drug therapy, or bruits in the abdomen or flank. Unexplained azotemia and recurrent pulmonary edema are possible in elderly patients with renovascular hypertension.

Nuclear medicine renography with the administration of Angiotensin-Converting Enzyme Inhibitors (ACEI) is commonly used in the diagnosis of renovascular hypertension. Patients should be well hydrated before testing, and if an oral ACEI is used they should not have a solid meal within 4 hours of the study.

Certain blood pressure medications should be withheld to improve the sensitivity of ACEI renography. Short-acting ACEIs, such as captopril, should be discontinued for 3 days before the study (other ACEI's 5-7 days). Angiotensin II receptor blockers such as losartan may have an effect similar to ACEIs and should be discontinued before this procedure. Chronic therapy with diuretics (i.e. furosemide) may lead to volume depletion thereby decreasing specificity and increasing the risk of symptomatic hypotension following ACEI administration. Calcium channel blockers such as diltiazem may cause renogram abnormalities and may be discontinued if not otherwise contraindicated. If possible, diuretics should be stopped several days before the study. In patients with severe hypertension, it may not be necessary to stop all antihypertensive medications before the procedure. If the patient's blood pressure returns to very high levels there may be a loss of sensitivity in this test.

Radiopharmaceuticals utilized for ACEI renography include Tc-99m MAG3™ and Tc-99m DTPA. A baseline study is necessary to evaluate the effects of the ACEI and is performed first when using a 1-day protocol. A 1 mCi dose of Tc-99m MAG3™ or Tc-99m DTPA is administered for baseline imaging and a second dose for the ACEI renogram should be 5 to 10 mCi to overwhelm any residual counts from the baseline exam. If a patient has a low likelihood of renovascular hypertension a 2-day protocol may be used. The ACEI renogram is performed on the first day, and if it is normal the patient need not return on the second day for the baseline study.

Captopril has been the most widely used ACEI for ACEI renography with a recommended dose 25-50 mg by mouth. The radiopharmaceutical should be administered 60 minutes after captopril to allow time for absorption. The alternative to captopril is enalaprilat. Enalaprilat is administered intravenously, 40 ug/kg over 3-5 minutes with a maximum dose of 2.5 mg. The radiopharmaceutical dose may be administered 15 minutes after enalaprilat. Furosemide may also be used along with an ACEI to improve detection of cortical retention of radiotracers, especially Tc-99m MAG3™.

Clinicians will evaluate the radionuclide renogram for ACEI-induced changes to determine if the patient has renovascular hypertension. A normal ACEI renogram dictates a low probability of renovascular hypertension. Bilateral symmetrical changes following ACEI administration also do not represent a positive study. Evidence of renovascular hypertension includes worsening of the renogram curve, reduction of relative uptake, prolongation or renal and parenchymal transit time, an increase in the 20 or 30-minute/peak ratio, and prolongation of the time to maximum activity. For Tc-99m MAG3™, unilateral parenchymal retention is the most important criterion. For Tc-99m DTPA, reduction in relative uptake is more predictive of renovascular hypertension.

Sources of error for this study include

infiltration of the radiotracer injection. This error can alter the shape of the renogram curve and interfere with quantitative measurements. Dehydration, hypotension, and failure to void the bladder may also decrease the sensitivity of the renogram.

If you have questions on this or any other procedure, or need a list of medications that may interfere with this study, please call and speak with a pharmacist.

Returning Radioactive Waste to Radiopharmacy

Title 49 of the Code of Federal Regulations 49 (CFR 49) contains the regulation for shippers of radioactive materials. Radiopharmacy is the shipper of orders you receive, but you are the shipper of material returned to us for disposal. Boxes returned for disposal must be **limited quantity** (as defined in 49 CFR) and be packaged and labeled appropriately (as specified in 49 CFR).

In order for a package to be a "limited quantity" all three of the following must apply; it may contain no more than the amounts of activity listed below, **and** the exposure rate on any surface may not exceed 0.5 mrem/hour, **and** non-fixed (removable) radioactive surface contamination on the external surfaces of the package may not exceed 6600 dpm from a wipe of 300 square centimeters (22dpm/square centimeter).

In order for the package to be labeled properly as a "limited quantity", both cards on the Radiopharmacy delivery cases must be turned over and placed on opposite sides of the box.

As always, if you are unsure of anything regarding returns, please give us a call.

Isotope	Quantity (mCi)	Isotope	Quantity (mCi)
Tc-99m	11	I-131	1.9
I-123	8.1	Co-57	27
Tl-201	11	Ga-67	8.1
In-111	8.1	Y-90	0.54

Survey Meter Calibration

Radiopharmacy, Inc. has an established relationship with Mid-America Calibrations, Inc. for survey meter calibrations. Mid-America Calibrations is fully certified, has been in business for over nine years, and has earned a reputation for performing quality work in a timely manner.

Radiopharmacy's price for survey

meter calibration is **\$45.00/meter**. Shipping and handling from and back to your location is \$20.00. Shipping will be by FedEx ground unless otherwise specified. We will pick up the instrument, send it to Mid-America Calibrations, and after calibration return it directly to you. If required, Radiopharmacy has rental survey meters while your unit is being calibrated.

Helpful Hints for the Preparation of Select Tc-99m Radiopharmaceuticals

Most radiopharmaceuticals are prepared by the simple addition of Tc-99m Sodium Pertechnetate to a vial that contains the drug and other necessary components for the labeling reaction. There are some key elements to this process, including the amount of activity added, the volume of liquid added, and the concept of negative pressure. It may also be necessary to fractionate the amount of drug in the vial for unit dose preparation. All manipulations should be made using aseptic technique and appropriate shielding.

The desired number of particles for a lung perfusion study with MAA is 200,000 to 700,000 particles. Each vial contains 3.5 to 6.5 million particles, so the number of particles must be reduced by about 90 percent in order to prepare a unit dose of MAA. The easiest way to accomplish this is to add a volume of sodium chloride to reconstitute the particles (5 mL), then withdraw 80 percent of the volume (4 mL) and discard it. This leaves 700,000 to 1,300,000 particles remaining in the vial that may be labeled with 8 to 10 mCi Tc-99m Pertechnetate. A reduced number of particles is necessary for pediatric patients and patients with certain lung disorders including pulmonary hypertension.

MAA, following reconstitution, is a suspension of particles. Before withdrawing a dose from the vial the particles must be resuspended by gently swirling. The particles in a unit dose may also need to be resuspended if allowed to settle for a length of time.

Both Choletec and MAA have a tendency to foam when a volume of liquid is added to the vial. This can make it difficult to draw the final patient dose. To minimize foaming, try adding volume slowly and down the inside of the vial.

Conserve Bulk Pertechnetate by adding no more than 25% more than the activity needed to draw the final patient dose.

Maintain negative pressure when

working with radioactive materials in vials. After adding volume to the vial it is important to remove an equal or greater quantity of air from the vial. When the needle is removed from the vial, the pressure inside will be the same or less than the initial pressure. If the air is not removed, the excess pressure in the vial will expel any liquid that is near the top of the vial. Of course, this would contaminate the work area with radioactivity.

Always use sodium chloride that is preservative free. Preservatives or oxidants will oxidize pertechnetate and reduce labeling.

If you have any questions about kit preparation, a pharmacist is always available to assist you.

SPECT Bone Imaging for Lower Back Pain

The February issue of *Radiology* features an article that summarizes a study of SPECT imaging in patients suffering from lower back pain. The goal of the study was to determine if this nuclear medicine procedure can help identify patients who would benefit from spinal injections. "Facet joint injections can be a good short-term alternative in some patients, but these injections don't help all patients, are relatively expensive, and can cause complications."

Forty-seven patients with low back pain, who were scheduled to receive facet joint injections, were studied. The subjects were divided into two groups, the first group had a bone scan before injection and the second did not. Patients showing positive SPECT results received injections at the joints indicated by the scan abnormalities. All other patients received injections as directed by the referring physician.

After one month of follow up, pain reduction was better in the group of patients who had positive SPECT studies. In addition, the referring physicians recommended a total of 60 injections for these patients, while the SPECT studies indicated only 27 abnormal sites for injection. This difference resulted in decreased cost and potential complications.

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If you have questions about anything in the "Monthly Scan" don't hesitate to call us at (812) 421-1002 or (800) 755-5889



www.radiopharmacy.com