### Hepatic Arterial Perfusion Imaging Before Y-90 Microspheres Treatment

**Primary Indications:** Hepatic arterial perfusion imaging is indicated to confirm that a hepatic arterial catheter (used for intra-arterial infusion of Y-90 microspheres (SIR-Spheres® or Theraspheres)) perfuses the liver without perfusion of other organs. The catheter is placed by the staff of Interventional Radiology. The prescribed administered activity for the therapeutic dosage of Y-90 microspheres is calculated based on a CT estimate of the percent of the liver involved with tumor and the amount of arteriovenous (AV) shunting in the liver. The amount of AV shunting in the liver is determined by dividing the counts in the lungs by the sum of the counts in the lungs and liver.

**Rationale:** To assess the position of an intra-arterial catheter, radiographic contrast material must be injected at a relatively high flow rate, and the resultant arteriographic images may not accurately reflect the distribution of substances injected at much lower flow rates. Particulate radiotracers (e.g., Tc-99m macroaggregated albumin [MAA]) can be injected slowly (<3 mL/min) and these particles will be trapped in downstream capillaries in proportion to relative regional blood flow. When brachytherapy agents are infused via arterial catheter, the goal is to perfuse the primary or metastatic tumor with the agent while avoiding perfusion of the spleen, stomach, gallbladder or bowel. AV shunting through the tumors result in accumulation of the particles in the capillaries in the lung. Significant intrahepatic AV shunting increases the chances that the Y-90 particles will deliver an unacceptable radiation dose to the lungs. If the ratio of counts in the lungs compared to the sum of the counts in the lung and liver is > 10%, the amount of administered activity of Y90 labeled microspheres may need to be altered.

**Interfering Conditions:** None

**Precautions:** Free Tc-99m pertechnetate will appear to concentrate in the stomach and may be misinterpreted as perfusion of this organ. Also, free Tc-99m may result in apparently increased activity in the lungs that is not due to intrahepatic AV shunting. Thus, recently made Tc-99m MAA with high labeling efficiency should be used.

**Radiopharmaceutical:** Tc-99m macroaggregated albumin (MAA)

**Adult Dosage:** 5 mCi in 3 mL of 0.9% saline solution. This dosage may be dispensed in two syringes each containing 2.5 mCi in 3 mL of 0.9% saline solution at the request of the Interventional Radiologist.

**Pediatric Dosage:** In the unlikely event that the study needs to be performed in a child, the dosage of Tc-99m MAA will be selected by the nuclear medicine staff physician.

**Radiation Dosimetry:** Adult. Critical organ (liver): 1.9 rem. Effective dose: 0.22 rem.

**Route of Administration:** Intra-arterial by slow injection (<3.0 mL/min) through a catheter in the hepatic artery.
Patient Scheduling: The patient will be scheduled initially in Interventional Radiology. The responsible attending Interventional Radiology physician or his/her designate will schedule this study by contacting the charge technologist at the North campus and faxing a requisition to the North campus front desk.

Patient Preparation: None

Equipment Setup: Gamma camera: LFOV camera. SPECT/CT
Collimator: Low-energy all-purpose.
Energy Window: 140 keV with 20% window

Patient Positioning: Supine for injection and for imaging. The radiopharmaceutical will be injected into the arterial catheter in the Interventional Radiology suite by a nuclear medicine physician or his/her designee. The patient then will be brought to the nuclear medicine department for imaging.

Necessary Supplies: The technologist will bring a plastic bag to the Interventional Radiology suite to collect the stopcock, the MAA syringe and the catheter through which the dose is injected as well as other disposables that may be contaminated.

Injection Procedure: With use of sterile technique, the dose should be injected slowly (<3 mL/min) through the catheter placed in the hepatic artery. No air should be injected. The catheter then should be slowly (<3 mL/min) flushed with 10 mL of normal saline solution. The catheter will then be withdrawn and placed in the plastic bag for transfer to the nuclear medicine suite. The patient will then be transferred to a stretcher and brought to the nuclear medicine department for imaging. The interventional radiologist should call the nuclear medicine reading room at the completion of the procedure to describe any unusual vascular anatomy, embolizations that were performed and where and how the radiopharmaceutical was injected.

Imaging Procedure: Following the injection of the radiopharmaceutical, an anterior planar image is obtained to include the liver, spleen and lung. If the liver and lung cannot be imaged in a single view, an anterior view of each of the two structures must be imaged separately for the same acquisition time. When imaged separately the total counts of the two regions-of-interest are used to manually calculate the ratio. When SPECT only images are acquired, fusion of SPECT with CT or MRI is optional but may be helpful in some cases.
Static Images
1. Anterior view(s) to include liver spleen and lung
   - 4-minute static image
   - 256 x 256 matrix, word mode
   - Spot image format with the total counts of the liver and lung

2. SPECT/CT of the liver.
   - See SPECT/CT Acquisition and Filtering Guidelines
   - Screenshots done by physician.

Image Processing: The following regions of interests (ROIs) should be drawn.
- Single ROI around both lungs (ROI_{lungs})
- Single ROI around the liver (ROI_{liver})

The counts in the ROI_{lungs} multiplied by 100 then divided by the sum of the counts in the ROI_{liver} and the ROI_{lungs} to give the percentage of activity in the lungs.

Items Required For Complete Study:

1. Static image(s) of liver and lung.

2. SPECT/CT of liver

3. Calculation of Lung/Liver ratio

4. Transfer of all digital images to workstation