PART VIII: LAST HOUSE OF DELEGATES APPROVAL DATE

January 14, 1996

PART IX: NEXT ANTICIPATED APPROVAL DATE

1998

ACKNOWLEDGMENTS

Henry D. Royal, MD, immediate past-chair of the Guidelines and Communications Committee, Commission on Health Care Policy and Practice, for overall coordination and oversight of the Society of Nuclear Medicine Guideline Development Project; Wendy J.M. Smith, MPH, Director of Health Care Policy, Society of Nuclear Medicine, for project coordination, data collection and editing; and members of the Guideline Development Subcommittee, Julia Blust, CNMT, Ronald Callahan, PhD, Robert Henkin, MD, and J. Anthony Parker, MD, PhD, who contributed their time and expertise to the development of this information.

Procedure Guideline for Hepatic and Splenic Imaging

Henry D. Royal, Manuel L. Brown, David E. Drum, Conrad E. Nagle, James M. Sylvester and Harvey A. Ziessman

Mallinckrodt Institute of Radiology, St. Louis, Missouri; University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania; West Roxbury Veterans Administration Hospital, Boston, Massachusetts; William Beaumont Hospital, Troy, Michigan; Our Lady of the Lake Medical Center, Baton Rouge, Louisiana; Georgetown University Medical Center, Washington, DC

Key Words: hepatic imaging; splenic imaging; procedure guideline

J Nucl Med 1998; 39:1114–1116

PART I: PURPOSE

The purpose of this guideline is to assist nuclear medicine practitioners in recommending, performing, interpreting and reporting hepatic and splenic imaging studies.

PART II: BACKGROUND INFORMATION AND DEFINITIONS

A. Liver-spleen imaging is performed following the injection of a ^{99m}Tc-labeled colloid that has been rapidly phagocytized by the reticuloendothelial cells of the liver, spleen and bone marrow.

B. Liver blood pool imaging is performed following the injection of ^{99m}Tc-labeled red blood cells for the detection of cavernous hemangiomas of the liver.

C. Hepatic perfusion studies are performed following the injection of ^{99m}Tc-macroaggregated albumin (MAA) through a hepatic artery catheter to determine that intra-arterially administered chemotherapeutic agents are optimally delivered.

D. Splenic imaging is performed following the injection of ^{99m}Tc-labeled heat-damaged red blood cells. Damaged red blood cells are selectively taken up by functioning splenic tissue.

PART III: COMMON INDICATIONS

A. Liver-Spleen Imaging

This study can be used to determine the size and shape of the liver and spleen as well as detect functional abnormalities of the reticuloendothelial cells of these organs. Specifically, these studies are occasionally performed for the following reasons:

1. Suspected focal nodular hyperplasia of the liver.

   These lesions often have normal or increased uptake on sulfur colloid (SC) imaging.
2. To assess the function of the reticuloendothelial system in patients with suspected liver disease.

   The decision to perform a liver biopsy or to continue treatment with a hepatotoxic agent may be influenced by the severity of liver disease that is seen on liver-spleen imaging.

B. Liver Blood Pool Imaging

This study is highly specific for cavernous hemangiomas of the liver. The sensitivity for detecting large lesions of the liver (>2 cm–3 cm) is also high. Hemangiomas as small as 0.5 cm may be detected with SPECT.

C. Hepatic Perfusion Imaging

This study is useful for demonstrating that hepatic artery catheters used to infuse chemotherapeutic agents are optimally positioned to perfuse liver tumors and to avoid perfusion of normal extrahepatic tissues (e.g., stomach).

D. Splenic Imaging

This study is used to detect functional splenic tissue. This study is often performed:

1. In children to rule out congenital asplenia or polysplenia.
2. In adults whose thrombocytopenia has been previously treated with splenectomy.
3. To characterize an incidentally noted mass as functional splenic tissue.

PART IV: PROCEDURE

A. Patient Preparation

No patient preparation is required.

B. Information Pertinent to Performing the Procedure

1. Relevant history and results of physical examination.
2. Results of other anatomic imaging studies.
3. Results of liver function tests.
4. For splenic imaging, results of a complete blood and platelet count.
5. For hepatic perfusion studies, position of the hepatic artery catheter.

C. Precautions

When red blood cells are labeled, strict adherence to a

For correspondence or reprints, contact: Wendy J.M. Smith, Director of Health Care Policy, Society of Nuclear Medicine, 1850 Samuel Morse Dr., Reston, VA 20190-5316, or by e-mail at wsmith@snm.org.

Note: All 26 SNM-approved procedure guidelines are available on the Society's home page. We encourage you to download these documents via the Internet at www.snm.org. If you would like information on the development of this guideline or to order a compendium of all 26 procedure guidelines for $20.00, contact Marie Davis, Society of Nuclear Medicine, at (703) 708-9000, ext. 250, or by e-mail at mdavis@snm.org.

TABLE 1
Radiation Dosimetry for Adults

Radiopharmaceutical	Administered activity MBq (mCi)	Organ receiving the largest radiation dose* mGy (rad)	Effective dose* mSv (rem)
^{99m}Tc-colloid†	150–220	0.077 Spleen	0.014
	(4–6)	(0.28)	(0.051)
^{99m}Tc red blood cells‡	750–925	0.023 Heart	0.0085
	(20–25)	(0.085)	(0.031)
^{99m}Tc-MAA	40–110	Variable Liver	Variable
	(1–3)	(Variable)	(Variable)
^{99m}Tc heat-damaged red blood cells§	40–110	0.56 Spleen	0.041
	(1–3)	(2.1)	(0.15)

*Per MBq (per mCi).
†ICRP 53, page 180.
‡ICRP 53, page 210.
§ICRP 53, page 212.

TABLE 2
Radiation Dosimetry for Children (5-yr-old)

Radiopharmaceutical	Administered activity MBq/kg (mCi/kg)	Organ receiving the largest radiation dose* mGy (rad)	Effective dose* mSv (rem)
^{99m}Tc-colloid†	1.5–2.2	0.25 Spleen	0.041
	(0.04–0.06)	(0.93)	(0.15)
^{99m}Tc red blood cells‡	7.0–11.0	0.062 Heart	0.025
	(0.2–0.3)	(0.23)	(0.093)
^{99m}Tc-MAA	1.5–2.2	Variable Liver	Variable
	(0.04–0.06)	(Variable)	(Variable)
^{99m}Tc heat-damaged red blood cells§	0.7–1.5	1.8 Spleen	0.13
	(0.02–0.04)	(6.6)	(0.48)

*Per MBq (per mCi).
†ICRP 53, page 180.
‡ICRP 53, page 210.
§ICRP 53, page 212.

procedure designed to prevent the administration of one patient's labeled red blood cells into another patient is mandatory. Procedures and quality assurance for correct identification of patients and handling blood products are essential. See the *Society of Nuclear Medicine Guideline for Imaging with Radiopharmaceuticals.*

D. Radiopharmaceutical (See Tables 1 and 2.)
   1. Liver-Spleen Imaging
      Technetium-99m-SC is preferred for liver-spleen imaging because the biodistribution and biokinetics of this agent are more reproducible than ^{99m}Tc-albumin colloid (AC).
   2. Liver Blood Pool Imaging
      Technetium-99m-labeled red blood cells can be labeled using in vitro, in vitro/in vivo or in vivo methods. Methods with higher labeling efficiency (in vitro/in vivo or in vitro methods) may improve imaging results.
   3. Hepatic Artery Perfusion Imaging
      Technetium-99m-MAA.
   4. Splenic Imaging
      Technetium-99m heat-damaged red blood cells.

E. Image Acquisition
   1. Liver-Spleen Imaging
      Imaging is begun 10–15 min or longer after the intravenous administration of ^{99m}Tc-colloid. Anterior, posterior, right lateral, right anterior oblique and right posterior oblique images of the liver are commonly obtained. Left posterior oblique and left lateral views are added for evaluating the spleen. For small-field-of-view gamma cameras and standard amounts of administered activity, images usually are collected for a minimum of 300,000–500,000 counts. For large-field-of-view gamma cameras, an anterior image is usually acquired for 500,000–1,000,000 counts. Subsequent images are then obtained for the same length of time as the anterior image. SPECT imaging may be helpful, particularly if focal disease is suspected.

      Breath-holding views may sometimes help clarify ambiguous findings by eliminating image degradation by respiratory motion. A size marker and a costal margin marker are needed for measuring liver and spleen size and for identifying anatomical landmarks.
   2. Hepatic Blood Pool Imaging
      A rapid sequence of images (1 frame per sec for 60 sec) immediately following injection may reveal useful information about regional variations in blood flow. This dynamic study should be performed in the view that is most likely to show the lesion. This view should be selected based on the location of the lesion of interest that usually has been documented on an earlier imaging study (i.e., CT, ultrasound or MRI). The initial flow study is optional.

      Immediate blood pool images may be obtained in the view most likely to show the lesion, as well as anterior, posterior and right lateral views. Generally, these views are acquired for 1,000,000–2,000,000 counts. These immediate images are optional.

      Delayed (45–180 min postinjection) blood pool images are obtained in the view most likely to show the lesion, as well as anterior, posterior and right lateral views. These views generally are acquired for 1,000,000–2,000,000 counts. When the lesion is small (less than 2 cm–3 cm) or if there are multiple lesions, SPECT imaging is preferred. If a high-quality delayed SPECT study is obtained, planar images are optional. SPECT facilitates comparison with CT.
   3. Hepatic Perfusion Imaging
      The radiopharmaceutical (^{99m}Tc-MAA) should be infused very slowly at a measured rate through the hepatic perfusion catheter to demonstrate the tissue perfused by the catheter at this rate. Imaging is performed immediately after the infusion of the agent. Anterior, posterior and right lateral images of the liver containing 500,000–1,000,000 counts typically are acquired. Images of the lung are required to identify intrahepatic arteriovenous fistulas.