

**Clinical Protocol: Gated Blood Pool Study**

**Responsible Division:** Division of Nuclear Medicine, Department of Radiology, UT Southwestern

**Date Last Reviewed: 05/2018**

**POLICY BASIS FOR PROCEDURE**

- To establish a protocol for gated blood pool radionuclide ventriculography

**DESCRIPTION OF STANDARD PROCEDURE**

**SCOPE**

All Nuclear Medicine Technologists and Physicians must adhere to these guidelines.

**PROCEDURE**

**Indications:**

- Evaluate ventricular regional wall motion (1,2)
- Quantitate ventricular ejection fractions (1-3)
- Monitor cardiotoxicity of doxorubicin (4,5)
- Differentiate pulmonary and cardiac causes of dyspnea

**Examination Time:**

- 1 hour

**Patient Preparation**

- Place 3 ECG leads on the patient
- Ensure good electrical contact; this can be done by preparing the skin with methyl alcohol and/or extra-fine sandpaper and shaving the area with a disposable razor, if needed (6)
- The right arm lead is placed in the region of the right axilla, the left arm lead in the region of the left axilla, and the right leg lead in the right upper quadrant of the abdomen.

**Equipment & Energy Windows:**

- Gamma camera: Small field of view. May use large field of view with electronic magnification.
- Collimator: Low energy, general purpose, parallel hole or low energy, high resolution, parallel hole.
- Energy windows: 20% window centered at 140 keV (7).

**Radiopharmaceutical, Dose, & Technique of Administration (8):**

Radiopharmaceutical:

- Tc-99m-labeled red blood cells.

Dose:

- 30-35 mCi (1,110-1,295 MBq)

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- Technique of administration:
  - Red blood cell labeling method (Either the in vivo/in vitro method or in vitro method gives high labeling efficiencies.)
    - In vivo/in vitro method
    - In vitro method:
      - In vitro method: Use the Tc-99m UltraTag RBC kit. Follow step by step instructions provided in the kit. The instructions are also available from the nuclear pharmacy. All Tc 99m Ultratag RBC preparation will be performed in compliance with USP <797>.
      - In patients with difficult veins, the in vivo method may be used
  - In patients with difficult veins, the in vivo method may be used

### Patient Position & Imaging Field:

- Patient position:
  - Supine
- Imaging field:
  - Center on the heart in the lower left chest.

### Acquisition Protocol:

Planar imaging:

- For patients in normal sinus rhythm, set the cardiac cycle length acceptance window at 20%. For patients with irregular rhythms, e.g. atrial fibrillation, set the cardiac cycle length acceptance window at a percentage greater than 20% if indicated and approved by the radiologist.
- Acquire the scan under the pre-set protocol on the acquisition camera.
- EKG gating: Connect patient to the EKG prior to starting the exam
- Acquire 300-400 beats per image in the RAO, LAO, Ant, LT LAT projections. The LAO acquisition is positioned to give maximum separation of the left and right ventricles as viewed in the persistence scope. The angle may be greater or less than 45 degrees.
- Use a 10-20 degree caudal tilt in the LAO projection to increase the separation of atria and ventricles.
- SPECT Imaging

### Data Processing:

- Calculate the left ventricular ejection fraction using the LAO projection, and the software and protocol provided with your computer
- Be sure that the regions of interest for background and the left ventricle are properly positioned throughout the cardiac cycle.
- If the software is available on your computer, create cine displays that alternate between just end systole and end diastole to facilitate evaluation of regional wall motion. This display facilitates wall motion evaluation.

### Optional Maneuvers:

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- SPECT acquisition: SPECT may be added to the EKG synchronized acquisition to give a series of cine tomograms of the heart. The tomographic approach is more time consuming, but improves the definition of cardiac chambers and regional wall motion. In addition, the three dimensional data of the gated SPECT images may be displayed in two dimensions using the technique of volume rendering.
- Phase analysis: A phase analysis and phase histogram may be constructed from the LAO projection.
- Parameters other than ejection fraction: These can be calculated from the left ventricular time-activity curve, but at this time their accuracy and clinical value are questionable

### Principle Radiation Emission and Dosimetry Data

#### Tc-99m

- Physical half-life = 6.01 hours.

Radiation	Mean % per disintegration	Mean energy (keV)
Gamma-2	89.07	140.5

### Dosimetry - Tc-99m-Labeled Red Blood Cells

Organ	rads/30-35 mCi	mGy/ 1,110-1,295MBq
Heart	2.4-3.36	24.0-33.6
Liver	2.16-3.02	21.6-30.24
Spleen	1.8-2.52	18.0-25.2
Lungs	1.68-2.35	16.8-23.52
Kidneys	1.68-2.35	16.8-23.52
Blood	1.68-2.35	16.8-23.52
Red marrow	0.96-1.34	9.6-13.44
Whole body	0.48-0.67	4.8-6.72
Effective dose	rems/30-35 mCi	mSv/1,110-1,295 MBq
Whole body	0.78-1.09	7.44-10.42

### References:

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