

GATED BLOOD POOL STUDY - REST AND/OR STRESS

Overview

- The stress electrocardiographic Gated Blood Pool Study evaluates left regional ventricular wall motion and ejection fraction at rest/stress. A radiotracer that is confined to the vascular space using Tc-99m-red blood cells, is used to acquire images of the heart at multiple intervals throughout the cardiac cycle. These images are displayed dynamically to evaluate wall motion visually and analyzed the regions of interest to quantitate LV ejection fraction.

Indications

- Detection of coronary artery disease
- Evaluation of stable angina
- Evaluate ventricular regional wall motion
- Quantitate ventricular ejection fractions
- Monitor cardiotoxicity of doxorubicin
- Differentiate pulmonary and cardiac causes of dyspnea

Examination Time

- 1.5 hours

Patient Preparation

- Patient position: Supine.
- Imaging field of view: Center on the heart in the lower left chest.
- The patient must have had nothing to eat or drink for 3 hours only if a Stress test is required.
- Place the patient on a bicycle exercise table (for stress).
- Place 3 EKG leads on the patient:

1. Ensure good electrical contact; preparing the skin with methyl alcohol and/or extra-fine sandpaper can do this.
2. 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 (25 cm) field of view camera.
- Collimator: Low energy, general purpose, parallel hole.
- Energy window: 20% window centered at 140 keV.
- Computer with gated blood pool software.
- Cardiac gating device either built into the camera or stand-alone.
- Exercise table/bicycle (if required).

Radiopharmaceutical, Dose, & Technique of Administration

- Radiopharmaceutical: Tc-99m-labeled red blood cells.
- Dose: 30 mCi (1,110 MBq).
- Red blood cell labeling method (Either the in vivo/in vitro method or in vitro method give high labeling efficiencies.):
 - o In vivo/in vitro method
 - o In vitro method
 - o In patients with difficult veins, the in vivo method may be used
- Injection technique: Flush method:
 1. Move patient's arms away from side so basilic vein is not compressed.
 2. Remove tourniquet.
 3. Rapidly inject labeled red blood cells.
 4. Flush with 10 mL of saline.

Patient Positioning & Imaging Field

- Patient position: Semi-erect (if stress is required).
- Imaging field of view: Center on the heart in the lower left chest.

Acquisition Protocol

For Rest and Stress

- Set the computer program to divide each cardiac cycle into 16 to 32 frames.
- Position the camera in the LAO projection in order to maximize separation of the right and left ventricles.
- Acquire 10 minute or 400 beats and collect LAO (best angle for separation) ANT, RAO, and L LAT projections on the computer. 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 45E.
 1. Use a 10-20E caudal tilt in the LAO projections to increase the separation of atria and ventricles.
 2. Forward gated time-activity curves are sufficiently accurate.

For Stress

- Strap the patient to the table to prevent movement during exercise.
- Position the camera for an LAO acquisition, i.e. maximum separation of the left and right ventricles plus a caudal tilt to enhance separation of the left ventricle from the left atrium.
- Acquire two 2-minute baseline resting studies.
- The patient begins exercise at approximately 300 kpm/min (kilopond-meters/ minute) and the level of exercise is increased by 100 kpm/min every 2.5 minutes.
- During the first 30 seconds of each exercise level the patient's heart rate is allowed to equilibrate; during the remaining 2 to 2.5 minutes an exercise study is acquired.
- The physician monitoring the stress test will determine when the test should be terminated.
- Following the end of exercise take a post-exercise image of the LAO for 10 minutes or 400 beats.

Data Processing

- Calculate the left ventricular ejection fraction for each LAO study, both resting and exercise using the software and protocol provided with your computer:

1. Be sure that the regions of interest for background and the left ventricle throughout the cardiac cycle are properly positioned.
- Display the resting and exercise (LAOs) simultaneously to facilitate interpretation.
 - 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.

Principle Radiation Emission Data - Tc-99m

- Physical half-life = 6.01 hours.

<u>Radiation</u>	<u>Mean % per disintegration</u>	<u>Mean energy (keV)</u>
Gamma-2	89.07	140.5

Dosimetry - Tc-99m-Labeled Red Blood Cells

<u>Organ</u>	<u>rads/30 mCi</u>	<u>mGy/1,110 MBq</u>
Heart	2.0	20.0
Liver	1.8	18.0
Spleen	1.5	15.0
Lungs	1.4	14.0
Kidneys	1.4	14.0
Blood	1.4	14.0
Red marrow	0.8	8.0
Whole body	0.4	4.0