UW Health
University of Wisconsin Hospital and Clinics

# Division of Nuclear Medicine Procedure / Protocol
# University Hospital and The American Center

**Myocardial Infarct or Amyloid (PYP)** **UPDATED: August 2019**

**Amyloid CPT CODES (only one option)**
**Amyloid Planar spot view, whole body and SPECT: both 78802 & 78803 routine**
**Amyloid Planar spot view and SPECT: 78803**
**Amyloid Planar spot view and whole body: 78802**
**Amyloid Planar spot view only: 78800**

**Infarct CPT CODES (only one)**
**Planar 78466**
**SPECT 78469**

## Indications:

- Infarct imaging is indicated for the detection of myocardial infarction when the electrocardiogram and the cardiac enzyme curve are not diagnostic. This occurs in a variety of situations such as:
  - Intraventricular conduction defects
  - Presentation of patient at a time after enzyme levels would have been expected to peak
  - Post coronary artery bypass
  - After cardioversion
  - After possible myocardial trauma
- Infarct imaging is also useful in determining the location and size of acute myocardial infarction.
- 99mTc-pyrophosphate imaging has been used 3-6 months after myocardial infarction and in patients with unstable angina to provide prognostic information.
- The test is also sensitive for cardiac amyloidosis.

## Patient Prep:

No preparation prior to injection; however, patient should be instructed after injection to drink
- Infarct: four 8-ounce glasses of liquid before returning for the scan
- Amyloid: four 8-ounce glasses of liquid over the next three hours

Patient should empty their bladder before imaging. Patient should drink plenty of fluids for at least 24 hours after radiopharmaceutical administration to aide in the clearance.

## Scheduling:

Allow 15 minutes for time of injection.

Imaging is scheduled 4-6 hours (60-minutes) post-injection for infarct and 1-hour (45 minutes) and 3-hours (90 minutes) post-injection for amyloid.

If for infarct, the study should be scheduled for the second or third day after the clinical event.

## Radiopharmaceutical & Dose:

99mTc-pyrophosphate (PYP)
Prescribed dose 15.0 mCi +/- 20% (12-18 mCi) and weight based per nomogram/NMIS

## Imaging Device:

Planar: Any GE Infinia Hawkeye, GE NM640 Optima or GE Millennium MPS with LEHR collimators
SPECT: All of the above except GE Millennium MPS

## Imaging Procedure:

Imaging will include both the planar and SPECT imaging as a routine. Consult the NM Faculty if the patient cannot endure the SPECT study.

1. Begin imaging
   a. Infarct: 4-6 hours post injection
   b. Amyloid: 1-hour post injection and 3 hours post injection.
2. Position the patient supine for imaging with arms up for all images. Consult the reading physician if patient cannot get arms out of imaging FOV.
3. Infarct Studies
   a. Statics
      i. ANTERIOR CHEST (include the shoulders), LAO 45 and LAO 70
      ii. 750kct for each image
      iii. Matrix 256x256
      iv. Zoom: 1.5
      v. Any of the above listed cameras
   b. SPECT
      i. 360-degree acquisition
      ii. 90 stops (4-degree azimuths)
      iii. 20 seconds/stop
      iv. Zoom 1.0
      v. Use any dual head SPECT cameras previously listed.
      vi. See table below for camera specific set up details.
4. Amyloid Studies
   a. 1-hour Imaging ANTERIOR CHEST (include the shoulders), LAO 45 and LAO 70. See Infarct static parameters above.
   b. 3-hour Imaging ANTERIOR CHEST (include the shoulders) use 1-hour planar technique. Whole Body pass using current whole bone scan technique.
   c. 3-hour imaging SPECT (only) imaging (acquisition parameters detailed on the next page). See Infarct SPECT parameters above.

| ***Infinia 2, 3 or Optima SPECT*** | |
|---|---|
| ***Tomo Key Parameters*** | |
| Mode | **H** |
| Start Angle | **0** |
| Patient Location | **Feet First Supine** |
| Use Body Contour | **No** |
| Zoom | **1.0** |
| Matrix | **64 x 64** |
| Pan Y | **0** |
| Select | **Step & Shoot** |
| Seconds | **20** |
| | |
| ***Tomo Corrections*** | |
| Energy session | **Tc99m** |
| Collimator | **LEHR** |
| COR Correction | **Check** |
| | |
| ***Tomo Location Parameters*** | |
| Mode | **H** |
| Start Angle | **0** |
| Patient Location | **Feet First Supine** |
| Use Body Contour | **No** |
| Detectors 1 and 2 | **Check** |
| Total Angular Range | **180** |
| View Angle | **4** |
| Direction | **CCW** |

| ***Infinia 1* SPECT** | |
|---|---|
| ***Tomo Key Parameters*** | |
| Mode | **H** |
| Start Angle | **0** |
| Patient Location | **Feet First Supine** |
| Use Body Contour | **No** |
| Zoom | **1.0** |
| Matrix | **64 x 64** |
| Pan Y | **0** |
| Select | **Step & Shoot** |
| Seconds | **20** |
| | |
| ***Tomo Corrections*** | |
| Energy session | **Tc99m** |
| Collimator | **LEHR** |
| COR Correction | **Check** |
| | |
| ***Tomo Location Parameters*** | |
| Mode | **H** |
| Start Angle | **0** |
| Patient Location | **Feet First Supine** |
| Use Body Contour | **No** |
| Detectors 1 and 2 | **Check** |
| Total Angular Range | **180** |
| View Angle | **4** |
| Direction | **CCW** |

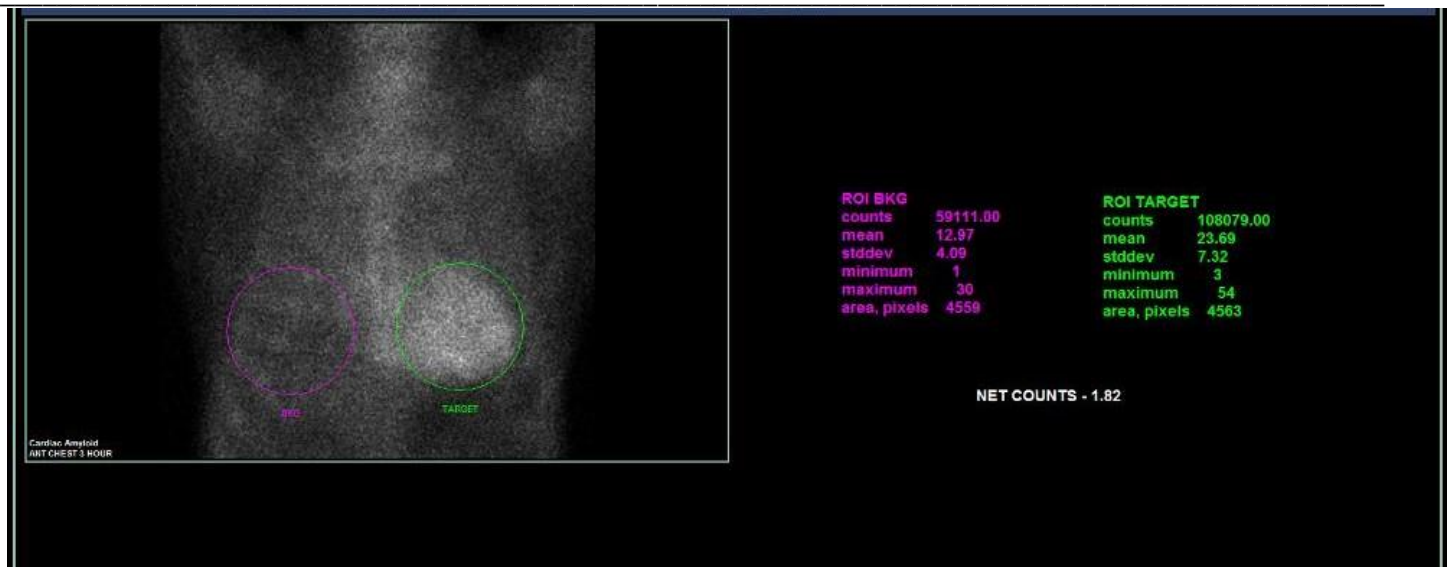
| | |
|---|---|
| Number of FOVs | **1** |
| FOV time multiplier | **1.0** |
| Rough Overlap | **4** |
| Direction | **Table In** |
| Select | **Default** |
| Motorized Pallet Support | **Check** |
| | |
| ***Tomo Admin Parameters*** | |
| Auto Apply | **No** |
| Release at end of scan | **Check** |
| NM | **None** |
| CT/AC | |
| FOV | |
| Body Part | **Chest** |
| Acquisition Context | **Unknown** |
| Body Side | **Other** |

| | |
|---|---|
| Check | **Release at end of scan** |
| **Table Height** | |
| Check | **Default** |
| | |
| | |
| ***Tomo Admin Parameters*** | |
| Body Part | **Chest** |
| Body Side | **Other** |

**Planar Processing, Display & PACS:**

For amyloid start on step 1. For Infarct jump down to step 18.

1. Select **ANT CHEST** image and click on **LOAD to NEW**
2. On the left-hand side select the circle ROI within the ROI Panel
3. Draw the circle ROI encompassing all of the patient's heart.
4. Under the ROI panel click on the pencil to edit the hearts ROI.
   a. Change the ROIs color to be green
   b. Change the label from roi0 to TARGET
   c. Click Apply & Quit
5. Select the button **Copy ROI to Clipboard** (icon with 2 pieces of paper)
6. Then select the button that is to the right to **Paste ROI from Clipboard** (icon with piece of paper and clipboard)
7. On the ANT CHEST image there will now be 2 ROIs encompassing the heart. Leave the ROI labeled TARGET over the patient's heart and move the ROI labeled ROI1 to the left of the sternum encompassing some of the ribs. Relabel ROI1 to BKG.
   a. Keep BKG on same plane of TARGET ROI.
8. Click on the **Stats Panel** (icon with bar graph), select **Value**. This displays data for the desired ROI.
9. Highlight data from ROI name down to area. Should include counts, mean, stddev, min, max and area (in pixels). Right click for copy. Hit OK to close the Value window.
10. Select Annotation tab (pencil button) and in the annotation text window right click to paste the data. You can edit the color of the text here also. Make sure the overlay box is checked and display the data in the box to the right of the image.
11. Copy and paste stats from both BKG and TARGET ROIs.
12. To get Net Counts Take the Target total counts and divide it by the Background total counts. This will give you the ratio. Label Ratio Below the two ROIs data
13. The Screen Cap below is an example of what it should look like when complete.
14. Screen Cap (DatabaseStudy 1024color) and properly label it **Heart Lung Ratio Screencap**




15. File Exit Workspace
16. Repeat processing steps 1-15 for ANT image acquired at 3 hours.
17. For Whole Body image acquired at 3 hours use whole body bone scan processing app and appropriately annotate, Amyloid WB 3 Hours. See Bone Scan Whole Body protocol.
18. Select the following raw images and click **LOAD to NEW**
    a. ANT CHEST, LAO 45, LAO 70
19. Properly annotate the image.
20. Screen Cap (DatabaseStudy 1024color) and save as **Amyloid Static ScreenCap**
21. Before exiting click on the annotation icon
22. Change the Image Label: to show Acq Info
23. Screen Cap (DatabaseStudy 1024color) and save as **Amyloid Statics W/ ACQ Data** ScreenCap
24. File and Exit Workspace

**SPECT Image Processing & PACS:**

1. See **GENERAL SPECT/CT PROCESSING** for processing and sending SPECT images to PACS. Be sure all image files are properly labeled indicating 3-hour delay.

2. Send all Raw Planar Images from hour 1 and 3 (ANT CHEST, LAO 45, LAO 70), Heart Lung Ratio Screen Cap made for both hour 1 and 3, Amyloid Static Screen Cap for hour 1, Amyloid Statics W/ ACQ Data Screen Cap for hour 1, 3 hour WB images to the **ALIArchive** station. Send the whole patient file to **MDXEL (cardiac Xeleris)**.

**Interpretation:**

**Infarct**

This test is very sensitive (~100%) for the detection of full thickness infarction, less sensitive (~70%) in partial thickness infarction. The persistence of activity beyond several days suggests either a ventricular aneurysm or poor prognosis. In case of doubtful positive (intensity of uptake is less than ribs) then repeating scan in 1-2 days which shows a scan pattern change means acute infarction is likely.

Tracer accumulation is myocardial infarctions usually occur maximally from 2-6 days after the infarction has occurred. Little accumulation is seen during the first 24 hours, which limits the usefulness of the technique in differential diagnosis of acute chest pain. Optimal uptake is 3-4 days post event.

**Amyloid**

Amyloid Grading

1. Quantitative: Region of interest comparison of heart and contralateral lung activity at 1 hour
   a. Calculated as a ratio of mean heart to contralateral lung activity
      - Ratio $\geq$ 1.5 is ATTR positive
      - Ratio < 1.5 is ATTR negative
      - Quantitative ratio valid when heart uptake visualized on SPECT images
   b. Semi-quantitative: visual comparison to bone (rib) uptake at 3 hours
2. Graded Myocardial 99mTc-PYP Update
      - Grade 0 No uptake and normal bone uptake
      - Grade 1 Uptake less than rib uptake
      - Grade 2 Uptake equal to rib uptake
      - Grade 3 Uptake greater than rib uptake with mild/absent rib uptake
   b. Positive scan Grade 2 or 3
      - Sensitivity 91%, Specificity 87% (reference 2)
   c. With use of blood test for negative for light chains,
      - Specificity and positive predictive value 100%

**References:**

1. Tc-Pyrophosphate Scintigraphy for differentiating light-chain Cardiac Amyloidosis … Circulation Cardiovasc Imaging 2013;6:195-201
2. NonBiopsy diagnosis of cardiac transthyretin amyloidosis. Circulation 2016;133:2404-2412
3. ASNC Practice Point: 99mTechnetium-Pyrophosphate Imaging for Transthyretin Cardiac Amyloidosis

Reviewed By:

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|---|---|---|
| Scott B. Perlman, MD, MS<br>Chief, Nuclear Medicine | Charles Stone, MD<br>Chief, Nuclear Cardiology | John Vetter, PhD, DABR<br>Medical Physicist |
| Derek Fuerbringer, CNMT<br>Manager, Nuclear Medicine<br>University Hospital | Kandace Nowakowski<br>Manager, Nuclear Medicine<br>The American Center | Scott Knishka, RPh, BCNP<br>Radiopharmacist |