Published in final edited form as:

J Nucl Cardiol. 2018 October ; 25(5): 1879–1884. doi:10.1007/s12350-017-1141-3.

Cardiac ATTR amyloid nuclear imaging—not all bone scintigraphy radionuclide tracers are created equal

Ji Can Yang, DO^a, Josef Fox, MD^b, Carol Chen, MD^a, and Anthony F. Yu, MD^a

^aCardiology Service, Department of Medicine, Memorial Sloan Kettering Cancer Center, New York, NY

^bDepartment of Radiology, Memorial Sloan Kettering Cancer Center, New York, NY

CASES

A 74-year-old Caucasian man with hypertension and hereditary hemochromatosis presented with new onset atrial fibrillation. An echocardiogram (TTE) showed marked concentric hypertrophy with abnormally low global longitudinal strain (GLS) of – 11.4% and apical sparing. Iron overload cardiomyopathy was ruled out by a cardiac MRI; however, diffuse late gadolinium uptake was suggestive of amyloid deposition. Serum immunofixation and free light chains were negative for AL amyloidosis. Wild-type (senile) transthyretin (ATTR) cardiac amyloidosis (CA) was suspected given patient's age. A ^{99m}Tc-methylene diphosphate (MDP) bone scan was carried out; however, it did not show any cardiac uptake (Figures 1, 2, Panel 1). Repeat imaging was performed using ^{99m}Tc-pyrophosphate (PYP), which showed intense tracer uptake diffusely in the myocardium (Figures 1 and 2, Panel 2).

A 79-year-old African-American woman with sarcoidosis presented with NYHA class III heart failure symptoms. TTE showed new severe eccentric LVH and severe global hypokinesis with EF 34%. Given the history of sarcoidosis, a cardiac MRI was obtained without evidence of cardiac sarcoidosis, but with diffuse late gadolinium enhancement suspicious for CA. Serum-free light chains and immunofixation were negative. Radionuclide bone scintigraphy was obtained first using ^{99m}Tc-MDP, but the images were equivocal for tracer uptake in the myocardium (Figures 3 and 4, Panel 3). The patient was reimaged using ^{99m}Tc-PYP which showed diffuse uptake in the myocardium (Figures 3 and 4, Panel 4), consistent with ATTR cardiac amyloidosis.

DISCUSSION

Radionuclide scintigraphy with technetium-labeled bisphosphonates is proposed as a reliable non-invasive strategy to diagnose ATTR cardiac amyloidosis.^{1,2} A recent study reported similar diagnostic accuracy using 3 different radiotracers: ^{99m}Tc-DPD (3,3-diphosphono-1,2-propanodicarboxylic acid), ^{99m}Tc-HMDP (hydroxymethylene diphosphonate), and ^{99m}Tc-PYP.³ We present 2 cases of ATTR cardiac amyloidosis in which

^{99m}Tc -MDP scintigraphy failed to show myocardial uptake. This suggests that ^{99m}Tc -MDP lacks sensitivity for diagnosis of ATTR cardiac amyloidosis and should not be used in this setting.

Acknowledgments

This work was funded in part through the NIH/NCI Cancer Center Support Grant P30 CA008748.

References

1. Bokhari M, Shahzad R, et al. Nuclear imaging modalities for cardiac amyloidosis. *J Nucl Cardiol*. 2013
2. ASNC Practice Points. ^{99m}Tc -Pyrophosphate Imaging for Transthyretin Cardiac Amyloidosis. 2016
3. Gillmore J, Maurer M, et al. Non-biopsy diagnosis of cardiac transthyretin amyloidosis. *Circulation*. 2016; 133:2404–12. [PubMed: 27143678]

Figure 1.

A Planar images of ^{99m}Tc -methylene diphosphate (MDP)—215 min following intravenous injection of 22 mCi of ^{99m}Tc -MDP, planar scan of the whole body from the vertex to the feet and spot images of the chest, and skull obtained, demonstrated lack of myocardial uptake. **B** Planar images of ^{99m}Tc -pyrophosphate (PYP)—90 min following intravenous injection of 22 mCi of ^{99m}Tc -PYP planar scan of the whole body and spot views of the chest were obtained, demonstrated grade 3 myocardial uptake (greater than ribs).

Figure 2.

Panel 1 (left): SPECT-CT images in coronal, sagittal, and axial planes of ^{99m}Tc -MDP following planar scan demonstrated the lack of myocardial uptake, in comparison with an uptake in the bones. Panel 2 (right): SPECT-CT images with ^{99m}Tc -pyrophosphate (PYP) following planar scan with an uptake in bones and diffuse myocardial uptake, more intense in the left ventricle.

Figure 3.

A Planar images of ^{99m}Tc -MDP—180 min following intravenous injection of 22 mCi of ^{99m}Tc -MDP, planar scan of the whole body demonstrated no myocardial uptake. **B** Planar images of ^{99m}Tc -PYP—60 min following intravenous injection of 19.1 mCi of ^{99m}Tc -PYP, planar scan of the whole body and spot views of the chest were obtained, demonstrated grade 3 myocardial uptake (greater than ribs).

Figure 4.

Panel 3 (left): SPECT-CT images in coronal, sagittal, and axial planes of ^{99m}Tc -MDP following planar scan demonstrated the lack of myocardial uptake, in comparison with an intense uptake in the sternum and vertebra. Panel 4 (right): SPECT-CT images with ^{99m}Tc -pyrophosphate (PYP) following planar scan with an uptake in bones and also diffuse myocardial uptake, more intense in the left ventricle.