Incremental Diagnostic Value of Serial Dual Radiopharmaceutical Metabolism and Perfusion CZT SPECT Imaging of Cardiac Amyloidosis

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INTRODUCTION

Cardiac SPECT imaging of Tc-99m bone radiopharmaceuticals with CT or simultaneous dual isotope imaging to define myocardial metabolic activity is reported to enhance diagnostic accuracy of cardiac ATTR amyloidosis (ATTR-CM). Without thallium-201, serial dual radiopharmaceutical (SDR) imaging using Tc-99m HMDP followed by Tc-99m sestamibi (MIBI) has been increasingly used, but its diagnostic accuracy remains undefined.

We assessed diagnostic classification of ATTR-CM using serial dual radiopharmaceutical (SDR) imaging:

1. **Compared to axial SPECT HMDP imaging alone;**
2. **By degree of patient motion and image quality.**

METHODS

Resting MIBI (8.0 - 9.9 mCi) was injected and imaging (MPI) acquired (5 min) promptly after 60-minute image acquisition of HMDP (8.0 - 9.9 mCi) with the D-SPECT CZT camera, (Spectrum Dynamics, Sarasota, FL).

Diagnostic category (negative, equivocal, positive) was analyzed in 101 consecutive patients referred for clinical evaluation of ATTR-CM using axial CZT SPECT HMDP and MIBI images (Figures 1A, 1B, 2A, 2B examples) compared to diagnostic category of orthogonal plane VLA, HLA and SAX CZT SPECT HMDP images using spatially cloned MPI derived LV myocardial region of interest (CMROI) (Figures 1C, 2C).

Two imaging experts (RGS FAB) assessed:

1. Diagnosis of ATTR CM with SDR compared to HMDP on axial CZT SPECT images.
2. Diagnosis, image quality, and patient motion on VLA, HLA, SAX CZT SPECT images compared to axial CZT SPECT images.
3. Questions were resolved by consensus.

Case 1 (7.2.24):
72 yo M with HFpEF, hypertension, dyslipidemia.

Positive study: HMDP on axial CZT SPECT appears in similar distribution to MIBI, as precisely displayed on SDR CMROI on SAX, VLA, HLA images

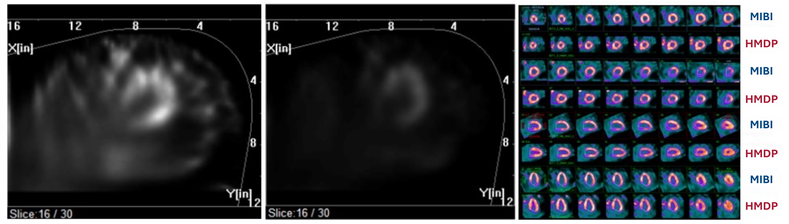

Figure 1A: Axial SPECT Tc-99m-HMDP | Figure 1B: Axial SPECT Tc-99m-MIBI | Figure 1C: SDR with CMROI

Case 2 (6.10.24):
44 yo M with a heterozygous Val142ILE TTR gene mutation, mother with ATTR-CM.

Negative study: HMDP on axial CZT SPECT is within RV and LV blood pool regions, precisely displayed on SDR CMROI on SAX, VLA, HLA images

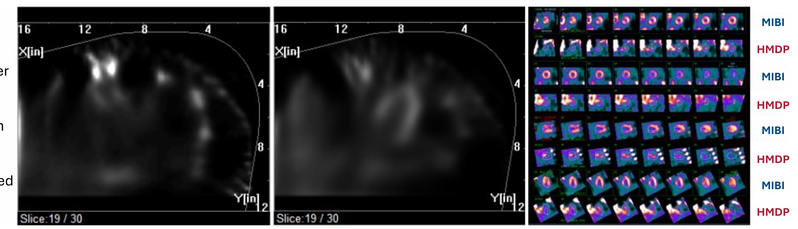

Figure 2A: Axial SPECT Tc-99m-HMDP | Figure 2B: Axial SPECT Tc-99m-MIBI | Figure 2C: SDR with CMROI

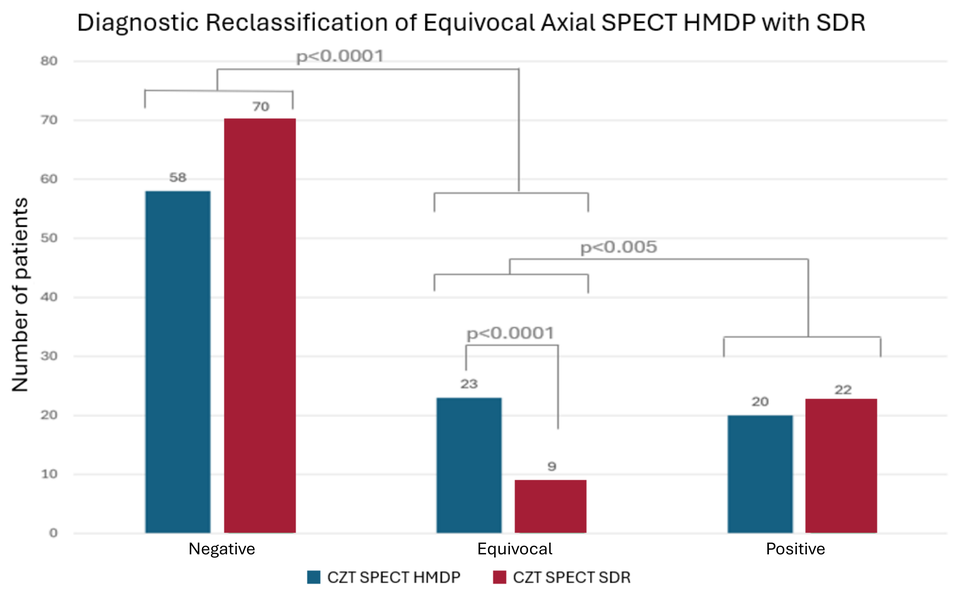

Figure 3: Visual interpretation of CZT SPECT HMDP (blue bars) and CZT SPECT SDR (red bars) in negative, equivocal and positive studies. SDR reclassified 14 of 23 (60.9%) of equivocal cases (P<0.0001).

RESULTS

Study quality was excellent or good in 95 and fair in 6 patients.

Patient motion was absent in 85 and minor without diagnostic effect in 16 patients.

HMDP identified ATTR-CM in 20 patients, was equivocal in 23, and negative in 58 patients.

Adding resting MPI (SDR) reclassified 14 of 23 (60.9%) equivocal HMDP cases, increased sensitivity by 10%, and identified additional normal cases in 21% ($P<0.0001$, Figure 3).

CONCLUSIONS

CZT SPECT high resolution perfusion metabolism SDR imaging with Tc-99m HMDP and MIBI in clinically referred patients with suspected ATTR-CM:

1. **Provides incremental diagnostic accuracy and efficiency (<90 min protocol) and is unaffected by patient motion;**
2. **Features ultra-low (<5 mSv) radiation exposure.**

Prospective evaluation of comparative diagnostic value and cost effectiveness of CZT SPECT SDR and SPECT CT appears warranted.