The time has come to standardize 123I-MIBG heart-to-mediastinum ratios including planar and SPECT methods

著者	Nakajima Kenichi, Okuda Koichi, Matsuo Shinro, Agostini Denis
journal or publication title	European Journal of Nuclear Medicine and Molecular Imaging
volume	43
number	2
page range	386-388
year	2016-02-01
URL	http://hdl.handle.net/2297/46406

doi: 10.1007/s00259-015-3258-4

The time has come to standardize ^{123}I-MIBG heart-to-mediastinum ratios including planar and SPECT methods

Eur J Nucl Med Mol Imaging 2016;43(2): 386-8.
doi: 10.1007/s00259-015-3258-4. Epub 2015 Nov 23.

Kenichi Nakajima *1, Koichi Okuda *2, Shinro Matsuo *1, Denis Agostini *3
*1 Department of Nuclear Medicine, Kanazawa University Hospital, Kanazawa, Japan
*2 Department of Physics, Kanazawa Medical University, Uchinada, Japan
*3 Department of Nuclear Medicine, CHU Côte de Nacre, Normandy University EA 4650, Caen, France

Bellevre et al. used D-SPECT (Spectrum Dynamics, Israel) with a cadmium zinc telluride-based camera for the determination of the heart-to-mediastinum ratio (HMR) of myocardial ^{123}I-metaiodobenzylguanidine (MIBG) uptake [1]. Since some institutions have changed their SPECT equipment from Anger SPECT to D-SPECT for cardiac studies, conventional planar images are not available in the routine clinical setting. Although the European Association of Nuclear Medicine (EANM) Cardiovascular Committee and the European Council of Nuclear Cardiology have recommended the use of medium-energy (ME) collimators for ^{123}I-MIBG studies [2], a number of hospitals still use low-energy (LE) collimators, and SPECT MIBG HMRs have been added recently.

While the ^{123}I-MIBG study has been widely used to patients with chronic heart failure and Levy body disease, most studies have used planar HMR [3–5]. Whether we can still use the previous numerous stock of data and how we can connect the follow-up data in the same series of patients are important issues. Considering the exchangeability of data between the Anger-type camera and D-SPECT, the authors of this study successfully used an anterior view equivalent planogram and introduced a correction formula to standardize the data between the two systems [1].

We have proposed the use of standardized HMR to the condition obtained with the most common ME general purpose collimators for all 123I-MIBG studies irrespective of the collimator used in an individual hospital [6, 7]. The conversion coefficient (CC) for the mathematical reference value using the most popular ME collimators was CC = 0.88 [7]. Therefore, an institutional HMR (HMRi) can be converted to the standard HMR (HMRstd) using the following equation: $\mathrm{HMRstd} = 0.88/\mathrm{CCi} \times (\mathrm{HMRi} - 1) + 1$, where CCi is the CC of the institutional camera/collimator system. The CC ranged from 0.5 to 1.0 depending on the collimator type used [1].

However, to extend the standardization of planar HMR to SPECT HMR, conversion between SPECT and planar studies again becomes important. We therefore recalculated the data of Bellevre et al. [1], assuming a LE high-resolution collimator with a CC of 0.55 (average CC of LEHR collimators) [7]. The relationships between D-SPECT HMR, the corrected HMR using the correction formula of Bellevre et al. and the standardized HMR based on the phantom method using the above equation are shown in Fig. 1. As found by Bellevre et al. [1], the regression line comparing the Anger camera HMR and D-SPECT HMR shows a slope of 1.64. After correction using the correction equation of Bellevre et al. the slope becomes 0.96 [1]. Based on our proposed conversion to standardized HMR, the slope becomes 1.02 with an intercept of −0.13 (Fig. 1c).

Using the correction D-SPECT HMR +0.1 gives a standardized HMR nearly equal to the HMR obtained using the ME collimator (CC 0.88). Since the HMR using the LEHR collimator of 1.6, which was used in the ADMIRE-HF study [3], can be converted to 1.9 using ME collimators, the corresponding dotted lines are shown in Fig. 1d, and indicate good concordance between conventional Anger camera and D-SPECT. Before generalizing the relationship for HMRs between D-SPECT and Anger camera, we need to know the CC of individual institutions and the reproducibility of planogram-based D-SPECT HMR among institutions, which might partly depend on preferences as to acquisition and processing conditions. However, calibrations between D-SPECT and Anger cameras are promising, and all the HMRs, from either planar imaging or SPECT, can be converted to comparable ME values as recommended by the EANM Cardiovascular Committee and the European Council of Nuclear Cardiology [2]. A larger amount of comparative data are required for validation of this method. The phantom-based calibration of HMR has already been performed in Japan in approximately 500 hospitals for standardization, and has just been started in some European countries.

Standardization is also important for identifying appropriate thresholds to differentiate good and bad prognoses [3–5], as well as for incorporating 123I-MIBG HMR into cardiac mortality risk models [8]. This standardization would also help create large databases in Europe, North America and Japan.

Fig. 1

a, **b** Linear regression analysis of the relationship between Anger camera HMR and D-SPECT HMR (**a**) and between D-SPECT HMR corrected and Anger camera HMR (**b**) using the data of Bellevre et al [1]. **c**, **d** Linear regression analysis of the relationship between standardized HMR (CC 0.88) and D-SPECT HMR (**c**) and between D-SPECT HMR + 0.1 (**d**). The *dotted lines* indicate HMR 1.6 and 1.9. The *shaded areas* denote confidence limits for the regression lines

Conflicts of interest K.N. has a collaborative research work for development of the software with FUJIFILM RI Pharma, Co. Ltd, Japan, supplier of 123I-MIBG (MyoMIBG) in Japan. The other authors declare no conflicts of interest.

Conflict of interest: KN has a collaborative research work for development of the software with FUJIFILM RI Pharma, Co. Ltd, Japan, supplier of ^{123}I-MIBG (MyoMIBG) in Japan.

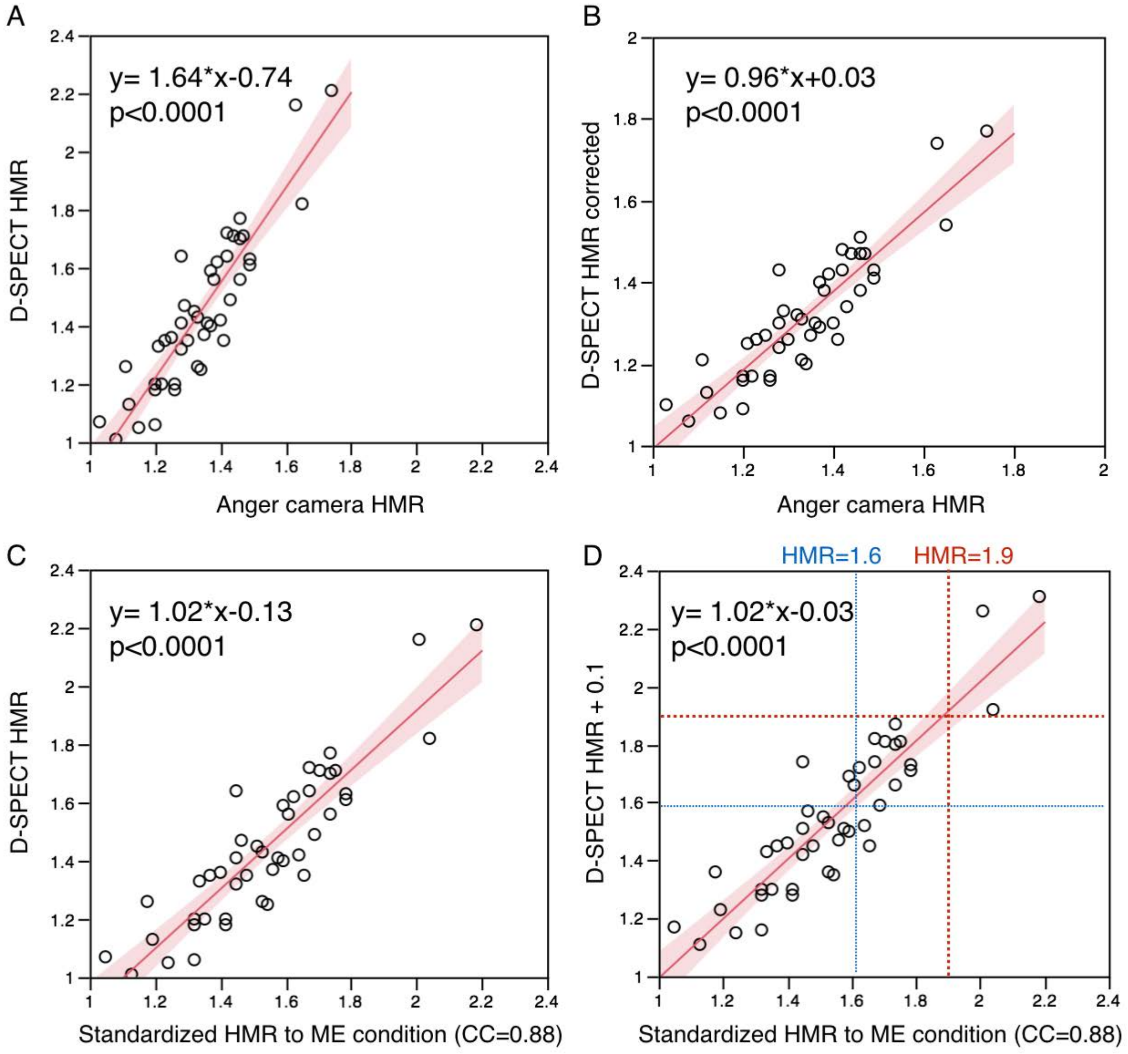

Figure 1

a, **b** Linear regression analysis of the relationship between Anger camera HMR and D-SPECT HMR (**a**) and between D-SPECT HMR corrected and Anger camera HMR (**b**) using the data of Bellevre et al [1]. **c**, **d** Linear regression analysis of the relationship between standardized HMR (CC 0.88) and D-SPECT HMR (**c**) and between D-SPECT HMR + 0.1 (**d**). The *dotted lines* indicate HMR 1.6 and 1.9. The *shaded areas* denote confidence limits for the regression lines

Reference

1. Bellevre D, Manrique A, Legallois D, Bross S, Baavour R, Roth N, et al. First determination of the heart-to-mediastinum ratio using cardiac dual isotope (^{123}I-MIBG/^{99m}Tc-tetrofosmin) CZT imaging in patients with heart failure: the ADRECARD study. Eur J Nucl Med Mol Imaging. 2015;42:1912-9.
2. Flotats A, Carrio I, Agostini D, Le Guludec D, Marcassa C, Schafers M, et al. Proposal for standardization of ^{123}I-metaiodobenzylguanidine (MIBG) cardiac sympathetic imaging by the EANM Cardiovascular Committee and the European Council of Nuclear Cardiology. Eur J Nucl Med Mol Imaging. 2010;37:1802-12.
3. Jacobson AF, Senior R, Cerqueira MD, Wong ND, Thomas GS, Lopez VA, et al. Myocardial iodine-123 meta-iodobenzylguanidine imaging and cardiac events in heart failure. Results of the prospective ADMIRE-HF (AdreView Myocardial Imaging for Risk Evaluation in Heart Failure) study. J Am Coll Cardiol. 2010;55:2212-21.
4. Nakata T, Nakajima K, Yamashina S, Yamada T, Momose M, Kasama S, et al. A pooled analysis of multicenter cohort studies of ^{123}I-mIBG imaging of sympathetic innervation for assessment of long-term prognosis in heart failure. JACC Cardiovasc Imaging. 2013;6:772-84.
5. Verschure DO, Veltman CE, Manrique A, Somsen GA, Koutelou M, Katsikis A, et al. For what endpoint does myocardial ^{123}I-MIBG scintigraphy have the greatest prognostic value in patients with chronic heart failure? Results of a pooled individual patient data meta-analysis. Eur Heart J Cardiovasc Imaging. 2014;15:996-1003.
6. Nakajima K, Okuda K, Matsuo S, Yoshita M, Taki J, Yamada M, et al. Standardization of metaiodobenzylguanidine heart to mediastinum ratio using a calibration phantom: effects of correction on normal databases and a multicentre study. Eur J Nucl Med Mol Imaging. 2012;39:113-9.
7. Nakajima K, Okuda K, Yoshimura M, Matsuo S, Wakabayashi H, Imanishi Y, et al. Multicenter cross-calibration of I-123 metaiodobenzylguanidine heart-to-mediastinum ratios to overcome camera-collimator variations. J Nucl Cardiol. 2014;21:970-8.
8. Nakajima K, Nakata T, Yamada T, Yamashina S, Momose M, Kasama S, et al. A prediction model for 5-year cardiac mortality in patients with chronic heart failure using ^{123}I-metaiodobenzylguanidine imaging. Eur J Nucl Med Mol Imaging. 2014;41:1673-82.