Int J Clin Exp Med 2017;10(4):6221-6236
www.ijcem.com /ISSN:1940-5901/IJCEM0042405

Original Article

The sensitivity and specificity of single photon emission computed tomography (SPECT) in the diagnosis of coronary artery disease (CAD): a meta-analysis

Xichun Sun[1*], Aibo Liu[2*], Zhonghua Jiang[1]

[1]Department of Medical Image, Yantai Hospital of Traditional Chinese Medicine, Yantai 264000, Shandong, China; [2]Department of Radiology, Yantaishan Hospital, Yantai 264001, Shandong, China. [*]Equal contributors.

Received March 27, 2016; Accepted December 16, 2016; Epub April 15, 2017; Published April 30, 2017

Abstract: Background: Coronary artery disease (CAD) is a serious threat to health with effective diagnostic methods significantly reducing its risk. While single photon emission computed tomography (SPECT), is an effective non-invasive diagnostic test with broad prospects for development, its sensitivity (SEN) and specificity (SPE) remain to be proven. Methods: All publications were searched through PubMed, Embase and Cochrane Library. Studies comparing SEN and false positive rate (FPR) of SPECT in the diagnosis of CAD were included. Data regarding relative outcomes in each study were extracted, based on SEN and FPR with 95% confidence intervals (CI). A meta-analysis was performed with several subgroup analyses. Further, the summary receiver operating characteristic (SROC) curve was plotted and its area under the curve (AUC) was calculated. Results: According to the results of meta-analysis, thallium-201 (Tl-201) is regarded as the best radiotracer with the largest partial AUC 0.86, SEN and FPR 0.82 (0.79, 0.85) and 0.25 (0.21, 0.29). Technetium-99m (Tc-99m) performs closely to Tl-201, as SEN of Tc-99m was 0.84 (0.82, 0.86), FPR 0.30 (0.27, 0.33), and partial AUC 0.85. However, there was no observed competitive advantage in combining Tl-201 together with Tc-99m. Although dual labeled compounds have highest SEN (0.85 (0.77, 0.91)), it FPR is lowest with FPR of 0.32 (0.25 to 0.39), partial AUC only 0.80. Conclusion: Tl-201 FPR was demonstrated to be the optimal radiotracer of SPECT in the diagnoses of CAD, and low-level exercise combined with pharmacologic agents was the preferable choice of SPECT stress inducer. To sum up, based on its SEN and FPR, SPECT can be widely used in CAD diagnosis.

Keywords: Coronary artery disease, single photon emission computed tomography, coronary angiography, technetium-99m, thallium-201, meta-analysis

Introduction

Coronary artery disease (CAD), also known as ischemic heart disease, is caused by insufficient myocardial blood supply, leading to stable angina, unstable angina, myocardial infarction, and sudden coronary death [1]. Since coronary circulation consists of the blood-supply vessels of the heart muscle myocardium, as so-called "end circulation", there are no compensatory or secondary branch vessels, which causes serious problems when any blockage occurs. Hypertension, smoking, hyperlipidemia, diabetes and physical inactivity are considered to be high risk factors [2], while familial inheritance is also one of the main causes. Atherosclerosis of coronary artery is the direct catalyst leading to CAD [3]. According to previous studies [4, 5], women are on served to be more vulnerable to CAD than men in similar conditions, and the risk of CAD increases with age. Meanwhile, ethnicity also plays an important role. Cardiovascular disease causes over 17 million worldwide deaths annually, and CAD accounts for the largest proportion of this [1]. According to Global Burden of Disease Study (GBD 2013), CAD was the primary cause of life loss in 2013 [6], although mortality in patients with CAD decreased between 1980 and 2010, a trend particularly strong in developed countries [7]. Another reason for such a high mortality rate is that CAD is difficult to diagnose as its initial primary symptom is chest pain after strenuous exercise or stress, which can dissipate after rest [8]. Therefore, an efficient, safe and accurate diagnostic method is necessary and at

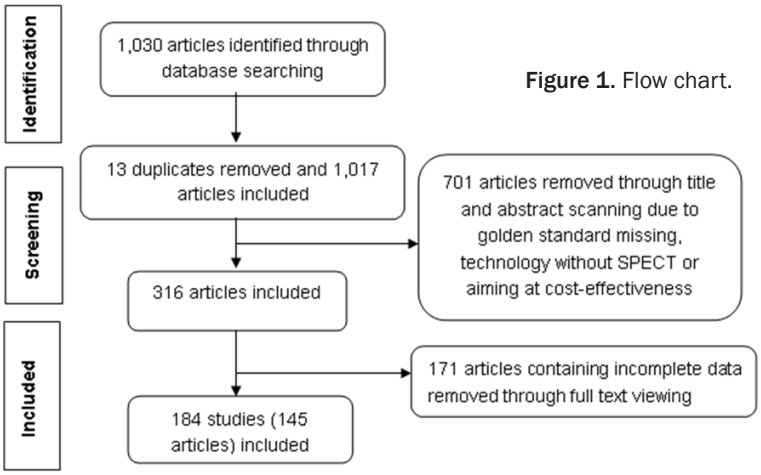

Figure 1. Flow chart.

present, based on the advice of National Heart, Lung, and Blood Institute, electrocardiogram (EKG), echocardiography, chest X-ray, single photon emission computed tomography (SPECT) and coronary angiography (CA) are the most common cardio logical diagnostic tests and procedures. All of the test methods can be classified into two groups: invasive (CA), and non-invasive, (EKG, X-ray, SPECT, etc). [9].

Since 1960, when the first CA was somewhat accidently carried out by Mason Sones [10], it has developed gradually and been accepted as the golden standard in consideration of its accuracy. Both the main and branch of coronary artery are visible under X-ray for the detection of occlusion, stenosis, restenosis, or thrombosis with the help of special coronary catheter puncturing into the artery and injection of radio contrast. Even though it is convenient to diagnosis, not everyone can tolerate radio contrast, and due to its invasive, this does not seem to be the optimal choice for patients with suspected CAD.

SPECT, one of the non-invasive methods, is increasing in popularity due to its general applicability and relative harmlessness. Computed tomography images can be obtained by varying the intensity of γ rays from different organs or parts of the body. According to the distinction between images under stress and at rest, doctors can diagnose myocardial ischemia, evaluate the lesion range and assess the degree of CAD [11].

In addition, there is much research on the sensibility (SEN) and false positive rate (FPR) of diagnosis of CAD, but the results vary significantly. For example, even using the same imaging isotope and stress inducer drug, the SPE in the study of Ogliby *et al.* turned out to be 100% [12], while Miller *et al.* suggests the SPE was only 27.5% [13]. Such difference was common in existing studies. Although there were several meta-analyses [14-16], most of the literatures were out of date or limited, and none of them considered the influence of ethnicity. To iron out these flaws, this meta-analysis would involve updated credible studies, and discuss the potential influential factors including tracer atom, stress and ethnicity.

Methods

Literature identification

By searching on PubMed, Embase and Cochrane Library, relevant literature identification was completed without language restriction. Meanwhile, keywords such as “coronary artery disease”, “coronary angiography”, “single photon emission computed tomography” and their synonyms were combined to use as searching terms. Besides this, reference lists of relavant literatures were searched and examined in case of any omission. All the potential literatures were assessed by two reviewers separately.

Inclusion criteria

Studies were included if they satisfied the following criteria: (i) all subjects included were suspected as CAD, with no limitation of patients’ ethnicity; (ii) SPECT must be used as one of the diagnostic tools, irrespective of type of radioactive tracer or stress inducer; (iii) the gold standard must be CA, irrespective of interpretation; (iv) a comparison must be performed in the study between SPECT and CA.

Data extraction

Independently, two reviewers screened the titles and abstracts of retrieved literatures, and in some cases, the full text was examined for

Table 1. Main results of meta-analysis

Study			Study Number	Sensitivity	False Positive Rate	AUC	Partial AUC
Overall			184	0.84 (0.82, 0.85)	0.28 (0.26, 0.31)	0.85	0.82
Thallium-201		Total	60	0.82 (0.79, 0.85)	0.25 (0.21, 0.29)	0.86	0.86
	Stress	Exercise	21	0.80 (0.73, 0.85)	0.30 (0.23, 0.39)	0.82	0.74
		Drug	26	0.83 (0.79, 0.87)	0.20 (0.16, 0.24)	0.88	0.72
		Dual	4	0.87 (0.78, 0.92)	0.39 (0.28, 0.51)	0.76	0.83
	Ethnicity	Caucasian	41	0.82 (0.79, 0.85)	0.26 (0.21, 0.31)	0.85	0.76
		Asian	19	0.83 (0.78, 0.87)	0.24 (0.18, 0.31)	0.87	0.76
Technetium-99m		Total	113	0.84 (0.82, 0.86)	0.30 (0.27, 0.33)	0.85	0.85
	Stress	Exercise	27	0.89 (0.86, 0.92)	0.34 (0.27, 0.41)	0.87	0.83
		Drug	47	0.83 (0.79, 0.86)	0.28 (0.24, 0.33)	0.84	0.79
		Dual	16	0.84 (0.80, 0.88)	0.27 (0.22, 0.33)	0.85	0.78
	Ethnicity	Caucasian	96	0.84 (0.82, 0.86)	0.31 (0.28, 0.34)	0.84	0.80
		Asian	17	0.88 (0.82, 0.92)	0.23 (0.18, 0.29)	0.88	0.72
Dual		Total	11	0.85 (0.77, 0.91)	0.32 (0.25, 0.39)	0.80	0.80
	Stress	Exercise	2	0.67 (0.30, 0.90)	0.29 (0.15, 0.50)	0.74	0.66
		Drug	3	0.88 (0.77, 0.94)	0.32 (0.22, 0.44)	0.82	0.83
		Dual	6	0.88 (0.79, 0.94)	0.34 (0.23, 0.48)	0.83	0.87

AUC: area under the curve. *FPR (false positive rate) = 1-SPE (specificity)*. Note: Stress types of some studies are not clear, as a result summary of studies numbers of Exercise, Drug and Dual may not equal the total number.

more details. Any disagreements regarding inclusion were solved under discussion. The following information was extracted: author, year of publication, country, diagnosed disease, the diagnostic technique employed, isotope, stress inducer and interpretation of SPECT, inclusion of CA as gold standard, and finally outcomes which represented data as true positive, false positive, true negative and false negative, and these were obtained to fulfill the 2 × 2 contingency table.

Statistical analysis

SEN and SPE of each test method were calculated, based on data showing in both true and false positives and negatives (2 × 2) contingency tables. Meanwhile, the heterogeneity among selected studies was tested through Cochran's Q, to find if the data could be pooled together. Usually, when $P < 0.01$ there was significant heterogeneity, and it was necessary to perform subgroup analyses. Moreover, if primary subgroup did not work very well, the secondary subgroup was used.

Furthermore, meta-analysis model of pooling all studies and of subgroup categorized by potential influencing factors were fitted for SEN and SPE with software R® version 3.2.1 (MathSoft, Cambridge, Massachusetts). The SEN and the SPE of SPECT compared with gold standard were expressed in the number less than 1 with 95% confidence intervals (CI). According to these data, a summary receiver operating characteristic (SROC) curve was performed, and the area under the SROC curve (AUC) was computed through the relative integral formula to reflect the SEN and SPE among different subgroups. The AUC values were in the range of 0 to 1, and if a diagnostic method was clearly superior, its AUC would be 1; and vice versa. Besides, to make our SROC curves more visible, instead of SPE, the FPR were used as abscissa. The conversion adopted was: *FPR = 1-SPE*.

Results

Included studies

This meta-analysis involved 184 studies collected from 145 articles with 19,182 subjects [12, 13, 17-159], since these all satisfied the criteria mentioned above. At first, 1,017 literatures contained the searching terms were identified and retrieved, after eliminating 13 duplicates. By skimming the title and abstract of identified articles, 846 were selected and the full texts were reviewed. Among them, 701

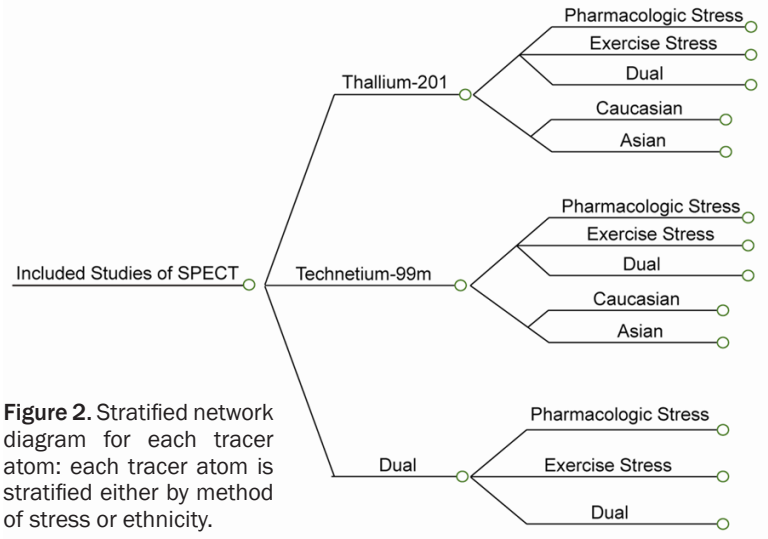

Figure 2. Stratified network diagram for each tracer atom: each tracer atom is stratified either by method of stress or ethnicity.

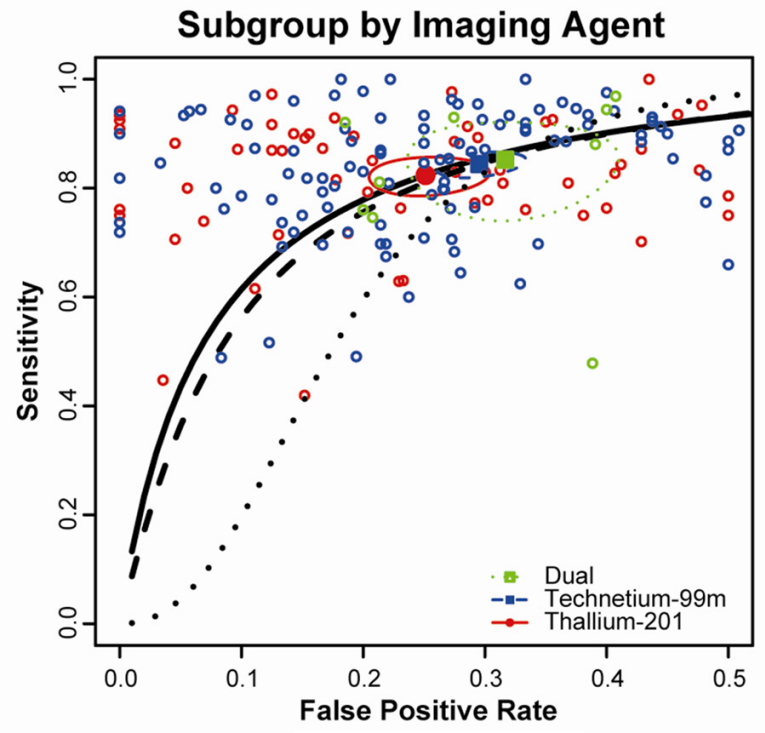

Figure 3. The summary receiver operator characteristic (SROC) curves shows the diagnostic power of three imaging agents to coronary artery disease.

studies were excluded, since they did not mention the gold standard, or did not make explicit the technology of SPECT, or were aimed at cost-effectiveness (**Figure 1**).

Characteristics of included studies

Among these 184 studies, 36 were targeted on Asian patients, while other studies were targeted on Caucasian ethnicities. Three types of radiotracer were involved, with technetium-99m (Tc-99m) the most common. Besides this, thallium-201 (Th-201) and Tc-99m plus Th-201 (Dual) were also used in some studies. Pharmacologic agents, exercise and both (Dual) were used to produce cardiac load. Adenosine, dipyridamole and dobutamine were employed as pharmacologic stress inducer. In addition, all the studies took CA as gold standard reference. Details of selected studies were shown in Table S1. The quality of included studies using QUADAS-2 was shown in Table S2.

Total SPECT

SEN and SPE of SPECT were compared with CA in all included studies. Pooling all data together, the overall SEN turned out to be 0.84 (0.82, 0.85), while the FPR was 0.28 (0.26, 0.31), and its partial AUC was 0.82, seen in **Table 1**.

Meanwhile, heterogeneity among all kinds of SPECT was calculated individually, as well as to SEN and SPE with *P* values less than 0.01, which could be deemed as existing significant heterogeneity. Considering the potential differences generated by various radiotracers, subgroup analysis was performed. Nevertheless, the heterogeneity was still extant between studies using same isotope. The secondary subgroup analyses were then conducted, in terms of stress inducer and ethnicity. Therefore, in this meta-analysis, to reduce error between different SPECT equipment and patients' race, two-class subgroup analyses were used, which meant all the studies were divided into three first-class subgroups, first with Tc-99m, Tl-201 and dual, and after that each primary subgroup was classified as pharmacologic stress inducer, exercise and both, or as Asian and Caucasian, as shown in **Figure 2**.

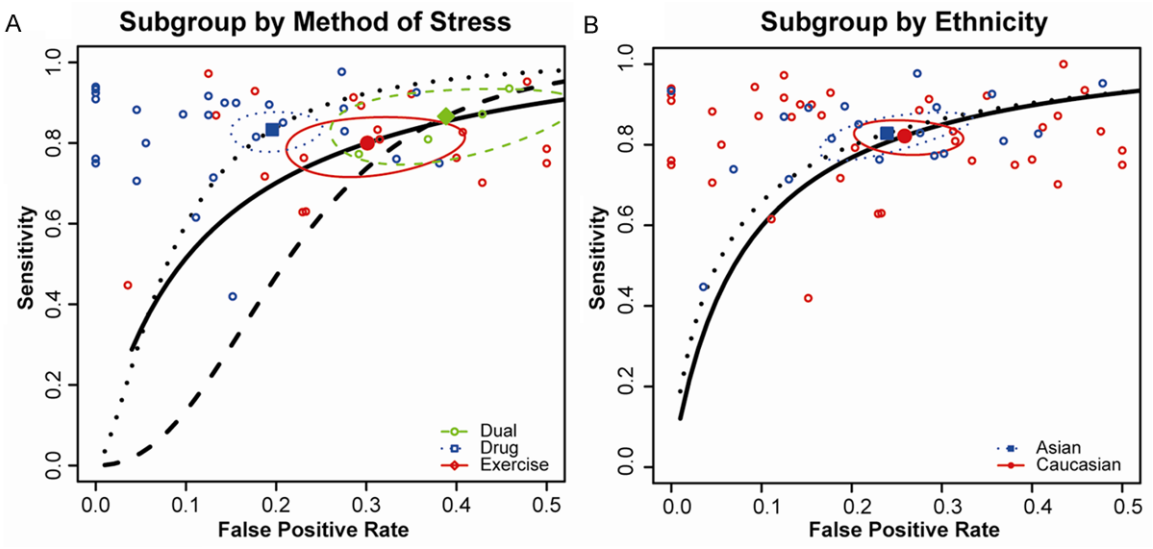

Figure 4. The summary receiver operator characteristic (SROC) curves based on subgroup analysis of Thallium-201. A. Method of Stress; B. Ethnicity.

Thallium-201

There were 60 studies related to Tl-201 included with SEN 0.82 (0.79, 0.85), lower than the overall SEN. But the SPE of Tl-201 was higher than the pooled data average, with FPR 0.25 (0.21, 0.29). Additionally, based on the SROC curve for total Tl-201 shown in **Figure 3**, its partial AUC was calculated as 0.86.

With regards to the SEN of secondary subgroup (stress inducer), exercise was 0.80 (0.73, 0.85), drug was 0.83 (0.79, 0.87), and combination of both components was 0.87 (0.78, 0.92). FPR for exercise was 0.30 with 95% CI 0.23 to 0.39, for drug 0.20 (0.16, 0.24), and for dual 0.39 (0.28, 0.51). According to SROC curve demonstrated in **Figure 4A**, the partial AUC for each inducer was 0.74, 0.71 and 0.83.

As for ethnicity, SEN was 0.82 with 95% CI ranging from 0.79 to 0.85, and 0.83 with 95% CI from 0.78 to 0.87 respectively for Caucasian and Asian respectively. FPR was 0.26 with 95% CI 0.21 to 0.31 for Caucasian, and 0.24 with 95% CI 0.18 to 0.31 for Asian. The partial AUC of the two ethnicities were both 0.76 as shown in **Figure 4B**.

Technetium-99m

Tc-99m was the most common isotope atom used as radiotracer, so 113 studies with 10,746 patients were involved. The SEN and FPR of total data were 0.84 with narrow 95% CI from 0.82 to 0.86, 0.30 with 95% CI from 0.27 to 0.33. Partial AUC shown in **Figure 3** was 0.85.

Categorized by stress inducer, exercise had the best SEN 0.89 with 95% CI from 0.86 to 0.92, but the worst SPE, since it FPR was 0.34 with 95% CI from 0.27 to 0.41. Additional, SEN and SPE of dual were both better than drug alone, since SEN of drug was 0.83 with 95% CI 0.79 to 0.86, of dual was 0.84 with 95% CI 0.80 to 0.88; FPR of drug was 0.28 with 95% CI 0.24 to 0.33, and of dual was 0.27 with 95% CI 0.22 to 0.33. However, considering these two aspects and after correction, the order was exercise, drug and dual, with partial AUC 0.83, 0.79 and 0.78 respectively, as shown in **Figure 5A**.

In view of the influence of ethnicity, the secondary subgroup was performed as Caucasian and Asian, and SEN was 0.84 with 95% CI from 0.82 to 0.86, 0.88 with 95% CI from 0.82 to 0.92, and FPR was 0.31 with 95% CI between 0.28 and 0.34, 0.23 with 95% CI between 0.18 and 0.29. Referring to SROC curve **Figure 5B**, the partial AUC was 0.80 for Caucasian and 0.72 for Asian.

Combination

The subgroup analysis of combination, which used both Tc-99m and Tl-201, included only 11

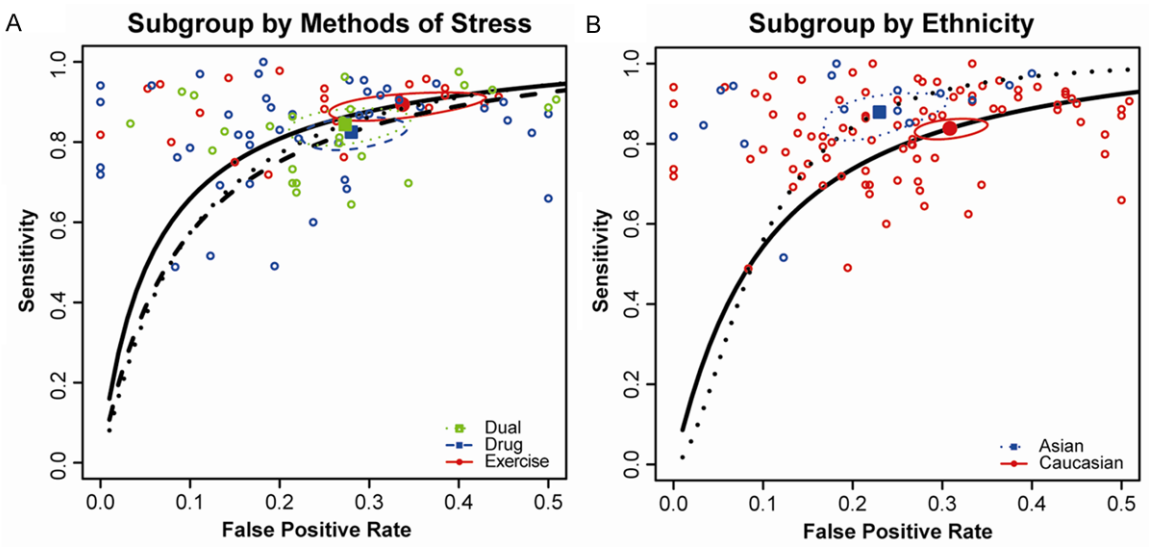

Figure 5. The summary receiver operator characteristic (SROC) curves based on subgroup analysis of Technetium-99m. A. Method of Stress; B. Ethnicity.

studies, and all subjects were Caucasian, with only second-class stress inducer being conducted. The merged data of dual showed that SEN was 0.85 and its 95% CI with limitation of 0.77 to 0.91, and FPR was 0.32, and 95% CI was 0.25 to 0.39. As illustrated in **Figure 3**, the partial AUC was 0.80.

In the secondary subgroup, both drug and dual stress inducers showed good performance in SEN, as their SEN was 0.88 with 95% CI 0.77 to 0.94, and 0.88 with 95% CI 0.79 to 0.94. FPR of each was 0.32 with 95% CI 0.22 to 0.44, and 0.34 with 95% CI 0.23 to 0.48. Although the SEN of exercise was 0.67 with wide 95% CI from 0.30 to 0.90, much lower than drug and dual, its FPR was 0.29 with 95% CI 0.15 to 0.50. To sum up, drug performed better than exercise, but worse than combination, as their partial AUC was 0.83, 0.66, and 0.87 in SROC curve.

Discussion

This meta-analysis gathered data from 184 studies of 145 articles with 19,182 total subjects, who were suspected to suffer from CAD, and all studies involved assessed the SEN and SPE of SPECT, compared with golden reference CA. Three types of radiotracers, three kinds of stress inducer, and two different ethnicities were tested and to minimize the probable influence generated by different SPECT equipment and races, they were categorized into two-class subgroups. The primary subgroup was Tc-99m, Tl-201 and dual, and the secondary subgroup was pharmacologic agent, exercise and both, or Asian and Caucasian. Due to non-invasiveness of ultrasound, this analysis was designed to investigate if the SEN and SPE of SPECT were high enough to be used widely in CAD diagnosis with isotope and stress inducer being the optimal choices. Additionally, this meta-analysis tried to asserta in whether the performance of SPECT had a significant difference among various ethnicities.

According to partial AUC of SROC curve for Tl-201, Tc-99m, and combination shown in **Figure 2**, Tl-201 seems to be the optimal radiotracer with partial AUC of 0.86, larger than overall AUC 0.82. Tc-99m was slightly behind Tl-201, of which the partial AUC was 0.85. Although combination had best performance in SEN, this constituted the lowest SPE and partial AUC 0.80 still indicated its lower performance. Tl-201 showed no significant difference in various ethnic groups, however, the partial AUC of Caucasian was 0.80 higher than 0.72 of Asian with reference to Tc-99m.

Radiotracers were crucial to SPECT performance, since it determined the SEN and SPE of SPECT directly, and currently Tl-201 and Tc-99m, including Tc-99m sestamibiand Tc-99m tetrofosmin, were quite common in the studies.

Tl-201, a radioactive isotope with 81 protons and 201 neutrons, was widely used as a radiotracer in the field of medicine. The half-life of Tl-201 is 74 hours, gamma decay with 80 keV emission energy. As for Tc-99m, a meta stable nuclear isomer of Tc-99, its half-life was around 6 hours, and it decays and emits 140 keV gamma rays. Both isotopes can be extracted by normally functional myocardial cells selectively. The first-pass extraction of Tl-201 can reach nearly 85%, while the first-pass extraction of Tc-99m was less. Besides this, due to the lack of redistribution, two injections at stress and rest separately were required when Tc-99m was served as radiotracer [160]. To avoid the interference on second test of standard one-day single-isotope SPECT and shorten diagnostic time [56], some studies used dual-isotope, which meant Tl-201 for rest and Tc-99m for stress. However, this protocol did not work successfully. Probably due to immature dual-isotope SPECT technique and equipment, it had the highest SEN with lowest SPE and wide confidential interval leading to its smallest partial AUC.

As for stress inducing method, exercise, pharmacologic agent and combination were frequently used to raise heartbeat and blood pressure to an adequate level. In consideration of side-effect and cost-efficiency, exercise was a convenient choice. But in some cases, as patients had certain concomitants, like high-risk unstable angina, uncontrolled hypertension. In conditions such as these where exercise is inadvisable, pharmacologic agents must be used. Common medicines used as stress inducer include adenosine, dipyridamole and dobutamine. Different drugs have different mechanisms, so medicine choice depends on patients' condition. In general, a combination of low-level exercise with drug infusion can decrease the drug side-effects and improve image quality [160]. Therefore, using the same radiotracer, dual stress inducers combined had better performance.

The diversities among isotope extraction, absorption of background tissues and organs, and clearance of organism of different ethnicities can all influence the performance of SPECT.

This meta-analysis compared SPECT with gold standard CA and indicated the SEN and SPE of three radiotracers and stress inducers applied to SPECT, and of two ethnicities in diagnosing CAD. However there were still some limitations: (i) to guarantee the quantity of selected studies, all the studies which met the criteria were included, so some data might have seen restriction from any accidental error, such as the influence of cell extraction generated by myocardial disease, and γ ray decay caused by excess fat or breast tissue, both of these factors can lead to misdiagnosis and increase false positive rate; (ii) the sample size of selected studies were varied. The smallest studies had just 16 subjects [150], while the largest one involved 785 patients [28]. So the small sample studies was easily diluted, which meant the large-size studies were dominant; (iii) although two-class subgroup analyses were performed, heterogeneity among each group was still extant, which might be resultant from the technique of SPECT, such as ECG-gated SPECT and attenuation correction SPECT, or method of SPECT image interpretation, as visual, semi-quantitative and quantitative.

Conclusions

Based on the present studies, Tl-201 seemed the optimal SPECT radiotracer aimed atmyocardial perfusion scintigraphy with highest SPE, and combined low-level exercise with pharmacologic agent was the preferable choice of stress inducer. However, the application of stress inducer of SPECT in practical clinical diagnosis needs to adequately consider the patient's condition. Additionally, extant studies were not enough to state the explicit connection between ethnicity and SPECT performance. Although SPECT was performed well in both SEN and SPE and can be widely used in CAD diagnosis, whether it can take the place of CA requires further research.

Disclosure of conflict of interest

None.

Address correspondence to: Zhonghua Jiang, Department of Medical Image, Yantai Hospital of Traditional Chinese Medicine, No. 39 Xingfu Road, Yantai 264000, Shandong, China. E-mail: huangyanliuvip@163.com

References

[1] Wong ND. Epidemiological studies of CHD and the evolution of preventive cardiology. Nat Rev Cardiol 2014; 11: 276-289.

[2] Mehta PK, Wei J and Wenger NK. Ischemic heart disease in women: a focus on risk factors. Trends Cardiovasc Med 2015; 25: 140-151.
[3] Hwang SJ, Ballantyne CM, Sharrett AR, Smith LC, Davis CE, Gotto AM Jr and Boerwinkle E. Circulating adhesion molecules VCAM-1, ICAM-1, and E-selectin in carotid atherosclerosis and incident coronary heart disease cases: the atherosclerosis risk in communities (ARIC) study. Circulation 1997; 96: 4219-4225.
[4] Kaski JC. Pathophysiology and management of patients with chest pain and normal coronary arteriograms (cardiac syndrome X). Circulation 2004; 109: 568-572.
[5] Koopman L P CN, Slorach C, et al.//CIRCULATION. 530 WALNUT ST, PHILADELPHIA, PA 19106-3621 USA: LIPPINCOTT WILLIAMS & WILKINS, 2010, 122(21). Epidemiology and Prevention of CV Disease: Physiology, Pharmacology and Lifestyle. CIRCULATION 2010; 122: 530.
[6] GBD 2013 Mortality and Causes of Death Collaborators. Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet 2015; 385: 117-171.
[7] Moran AE, Forouzanfar MH, Roth GA, Mensah GA, Ezzati M, Murray CJ and Naghavi M. Temporal trends in ischemic heart disease mortality in 21 world regions, 1980 to 2010: the Global Burden of Disease 2010 study. Circulation 2014; 129: 1483-1492.
[8] Bugiardini R, Manfrini O, Pizzi C, Fontana F and Morgagni G. Endothelial function predicts future development of coronary artery disease: a study of women with chest pain and normal coronary angiograms. Circulation 2004; 109: 2518-2523.
[9] Hwang IC, Kim YJ, Kim KH, Shin DH, Lee SP, Kim HK and Sohn DW. Diagnostic yield of coronary angiography in patients with acute chest pain: role of noninvasive test. Am J Emerg Med 2014; 32: 1-6.
[10] Nissen S. Coronary angiography and intravascular ultrasound. Am J Cardiol 2001; 87: 15A-20A.
[11] Zhou T, Yang LF, Zhai JL, Li J, Wang QM, Zhang RJ, Wang S, Peng ZH, Li M and Sun G. SPECT myocardial perfusion versus fractional flow reserve for evaluation of functional ischemia: a meta analysis. Eur J Radiol 2014; 83: 951-956.
[12] Ogilby JD, Kegel JG, Heo J and Iskandrian AE. Correlation between hemodynamic changes and tomographic sestamibi imaging during dipyridamole-induced coronary hyperemia. J Am Coll Cardiol 1998; 31: 75-82.
[13] Miller DD, Younis LT, Chaitman BR and Stratmann H. Diagnostic accuracy of dipyridamole technetium 99m-labeled sestamibi myocardial tomography for detection of coronary artery disease. J Nucl Cardiol 1997; 4: 18-24.
[14] Single photon emission computed tomography for the diagnosis of coronary artery disease: an evidence-based analysis. Ont Health Technol Assess Ser 2010; 10: 1-64.
[15] Parker MW, Iskandar A, Limone B, Perugini A, Kim H, Jones C, Calamari B, Coleman CI and Heller GV. Diagnostic accuracy of cardiac positron emission tomography versus single photon emission computed tomography for coronary artery disease: a bivariate meta-analysis. Circ Cardiovasc Imaging 2012; 5: 700-707.
[16] Takx RA, Blomberg BA, El Aidi H, Habets J, de Jong PA, Nagel E, Hoffmann U and Leiner T. Diagnostic accuracy of stress myocardial perfusion imaging compared to invasive coronary angiography with fractional flow reserve meta-analysis. Circ Cardiovasc Imaging 2015; 8.
[17] Abramson BL, Ruddy TD, deKemp RA, Laramee LA, Marquis JF and Beanlands RS. Stress perfusion/metabolism imaging: a pilot study for a potential new approach to the diagnosis of coronary disease in women. J Nucl Cardiol 2000; 7: 205-212.
[18] Acampa W, Cuocolo A, Sullo P, Varrone A, Nicolai E, Pace L, Petretta M and Salvatore M. Direct comparison of technetium 99m-sestamibi and technetium 99m-tetrofosmin cardiac single photon emission computed tomography in patients with coronary artery disease. J Nucl Cardiol 1998; 5: 265-274.
[19] Aggeli C, Christoforatou E, Giannopoulos G, Roussakis G, Kokkinakis C, Barbetseas J, Vlachopoulos C and Stefanadis C. The diagnostic value of adenosine stress-contrast echocardiography for diagnosis of coronary artery disease in hypertensive patients: comparison to Tl-201 single-photon emission computed tomography. Am J Hypertens 2007; 20: 533-538.
[20] Aksut SV, Pancholy S, Cassel D, Cave V, Heo J and Iskandrian AS. Results of adenosine single photon emission computed tomography thallium-201 imaging in hemodynamic nonresponders. Am Heart J 1995; 130: 67-70.
[21] Amanullah AM, Berman DS, Hachamovitch R, Kiat H, Kang X and Friedman JD. Identification of severe or extensive coronary artery disease in women by adenosine technetium-99m sestamibi SPECT. Am J Cardiol 1997; 80: 132-137.
[22] Amanullah AM, Bevegard S, Lindvall K and Aasa M. Assessment of left ventricular wall motion in angina pectoris by two-dimensional

echocardiography and myocardial perfusion by technetium-99m sestamibi tomography during adenosine-induced coronary vasodilation and comparison with coronary angiography. Am J Cardiol 1993; 72: 983-989.

[23] Astarita C, Palinkas A, Nicolai E, Maresca FS, Varga A and Picano E. Dipyridamole-atropine stress echocardiography versus exercise SPECT scintigraphy for detection of coronary artery disease in hypertensives with positive exercise test. J Hypertens 2001; 19: 495-502.

[24] Avakian SD, Grinberg M, Meneguetti JC, Ramires JA and Mansur AP. SPECT dipyridamole scintigraphy for detecting coronary artery disease in patients with isolated severe aortic stenosis. Int J Cardiol 2001; 81: 21-27.

[25] Banzo I, Pena FJ, Allende RH, Quirce R and Carril JM. Prospective clinical comparison of non-corrected and attenuation- and scatter-corrected myocardial perfusion SPECT in patients with suspicion of coronary artery disease. Nucl Med Commun 2003; 24: 995-1002.

[26] Becker M, Hundemer A, Zwicker C, Altiok E, Krohn T, Mottaghy FM, Lente C, Kelm M, Marx N and Hoffmann R. Detection of coronary artery disease in postmenopausal women: the significance of integrated stress imaging tests in a 4-year prognostic study. Clin Res Cardiol 2015; 104: 258-271.

[27] Benoit T, Vivegnis D, Lahiri A, Itti R, Braat S and Rigo P. Tomographic myocardial imaging with technetium-99m tetrofosmin. Comparison with tetrofosmin and thallium planar imaging and with angiography. Eur Heart J 1996; 17: 635-642.

[28] Berman DS, Kang X, Nishina H, Slomka PJ, Shaw LJ, Hayes SW, Cohen I, Friedman JD, Gerlach J and Germano G. Diagnostic accuracy of gated Tc-99m sestamibi stress myocardial perfusion SPECT with combined supine and prone acquisitions to detect coronary artery disease in obese and nonobese patients. J Nucl Cardiol 2006; 13: 191-201.

[29] Beygui F, Le Feuvre C, Maunoury C, Helft G, Antonietti T, Metzger JP and Vacheron A. Detection of coronary restenosis by exercise electrocardiography thallium-201 perfusion imaging and coronary angiography in asymptomatic patients after percutaneous transluminal coronary angioplasty. Am J Cardiol 2000; 86: 35-40.

[30] Blankstein R, Shturman LD, Rogers IS, Rocha-Filho JA, Okada DR, Sarwar A, Soni AV, Bezerra H, Ghoshhajra BB, Petranovic M, Loureiro R, Feuchtner G, Gewirtz H, Hoffmann U, Mamuya WS, Brady TJ and Cury RC. Adenosine-induced stress myocardial perfusion imaging using dual-source cardiac computed tomography. J Am Coll Cardiol 2009; 54: 1072-1084.

[31] Bokhari S, Shahzad A and Bergmann SR. Superiority of exercise myocardial perfusion imaging compared with the exercise ECG in the diagnosis of coronary artery disease. Coron Artery Dis 2008; 19: 399-404.

[32] Boomsma MM, Niemeyer MG, van der Wall EE, van Eck-Smit BL, Zwinderman AH, Boomsma JH and Pauwels EK. Tc-99m tetrofosmin myocardial SPECT perfusion imaging: comparison of rest-stress and stress-rest protocols. Int J Card Imaging 1998; 14: 105-111.

[33] Borges-Neto S, Mahmarian JJ, Jain A, Roberts R and Verani MS. Quantitative thallium-201 single photon emission computed tomography after oral dipyridamole for assessing the presence, anatomic location and severity of coronary artery disease. J Am Coll Cardiol 1988; 11: 962-969.

[34] Chammas E, Yatim A, Hage C, Sokhn K, Tarcha W and Ghanem G. Evaluation of Tc-99m tetrofosmin scan for coronary artery disease diagnosis. Asian Cardiovasc Thorac Ann 2002; 10: 244-247.

[35] Chen L, Wang X, Bao J, Geng C, Xia Y and Wang J. Direct comparison of cardiovascular magnetic resonance and single-photon emission computed tomography for detection of coronary artery disease: a meta-analysis. PLoS One 2014; 9: e88402.

[36] Ciavolella M, Tomai F, Vicchio D, Ruscitti G, Giannitti C, Scali D, Schad N and Reale A. Single-day combined evaluation of regional myocardial perfusion and function at rest and peak exercise with 99mTc-MIBI in patients with coronary artery disease. Int J Card Imaging 1993; 9: 299-311.

[37] Cramer MJ, Verzijlbergen JF, van der Wall EE, Vermeersch PH, Niemeyer MG, Zwinderman AH, Ascoop CA and Pauwels EK. Comparison of adenosine and high-dose dipyridamole both combined with low-level exercise stress for 99Tcm-MIBI SPET myocardial perfusion imaging. Nucl Med Commun 1996; 17: 97-104.

[38] Daou D, Delahaye N, Vilain D, Lebtahi R, Faraggi M and Le Guludec D. Identification of extensive coronary artery disease: incremental value of exercise TI-201 SPECT to clinical and stress test variables. J Nucl Cardiol 2002; 9: 161-168.

[39] Di Bello V, Bellina CR, Gori E, Molea N, Talarico L, Boni G, Magagnini E, Matteucci F, Giorgi D, Lazzeri E, Bertini A, Romano MF, Bianchi R and Giusti C. Incremental diagnostic value of dobutamine stress echocardiography and dobutamine scintigraphy (technetium 99m-labeled sestamibi single-photon emission computed tomography) for assessment of presence and extent of coronary artery disease. J Nucl Cardiol 1996; 3: 212-220.

[40] Dondi M, Fagioli G, Salgarello M, Zoboli S, Nanni C and Cidda C. Myocardial SPECT: what do we gain from attenuation correction (and when)? Q J Nucl Med Mol Imaging 2004; 48: 181-187.
[41] Elhendy A, Schinkel AF, Bax JJ, van Domburg RT, Valkema R, Biagini E, Feringa HH and Poldermans D. Accuracy of stress Tc-99m tetrofosmin myocardial perfusion tomography for the diagnosis and localization of coronary artery disease in women. J Nucl Cardiol 2006; 13: 629-634.
[42] Elhendy A, Schinkel AF, van Domberg RT, Bax JJ, Valkema R and Poldermans D. Non-invasive diagnosis of in stent stenosis by stress 99m technetium tetrofosmin myocardial perfusion imaging. Int J Cardiovasc Imaging 2006; 22: 657-662.
[43] Elhendy A, van Domburg RT, Bax JJ, Nierop PR, Geleijnse ML, Ibrahim MM and Roelandt JR. Noninvasive diagnosis of coronary artery stenosis in women with limited exercise capacity: comparison of dobutamine stress echocardiography and 99mTc sestamibi single-photon emission CT. Chest 1998; 114: 1097-1104.
[44] Elhendy A, van Domburg RT, Bax JJ, Poldermans D, Sozzi FB and Roelandt JR. Accuracy of dobutamine technetium 99m sestamibi SPECT imaging for the diagnosis of single-vessel coronary artery disease: comparison with echocardiography. Am Heart J 2000; 139: 224-230.
[45] Elhendy A, van Domburg RT, Sozzi FB, Poldermans D, Bax JJ and Roelandt JR. Impact of hypertension on the accuracy of exercise stress myocardial perfusion imaging for the diagnosis of coronary artery disease. Heart 2001; 85: 655-661.
[46] Emmett L, Iwanochko RM, Freeman MR, Barolet A, Lee DS and Husain M. Reversible regional wall motion abnormalities on exercise technetium-99m-gated cardiac single photon emission computed tomography predict high-grade angiographic stenoses. J Am Coll Cardiol 2002; 39: 991-998.
[47] Esteves FP, Galt JR, Folks RD, Verdes L and Garcia EV. Diagnostic performance of low-dose rest/stress Tc-99m tetrofosmin myocardial perfusion SPECT using the 530c CZT camera: quantitative vs visual analysis. J Nucl Cardiol 2014; 21: 158-165.
[48] Fagret D, Marie PY, Brunotte F, Giganti M, Le Guludec D, Bertrand A, Wolf JE, Piffanelli A, Chossat F, Bekhechi D, et al. Myocardial perfusion imaging with technetium-99m-Tc NOET: comparison with thallium-201 and coronary angiography. J Nucl Med 1995; 36: 936-943.
[49] Ficaro EP, Fessler JA, Shreve PD, Kritzman JN, Rose PA and Corbett JR. Simultaneous transmission/emission myocardial perfusion tomography. Diagnostic accuracy of attenuation-corrected 99mTc-sestamibi single-photon emission computed tomography. Circulation 1996; 93: 463-473.
[50] Forster S, Rieber J, Ubleis C, Weiss M, Bartenstein P, Cumming P, Klauss V and Hacker M. Tc-99m sestamibi single photon emission computed tomography for guiding percutaneous coronary intervention in patients with multivessel disease: a comparison with quantitative coronary angiography and fractional flow reserve. Int J Cardiovasc Imaging 2010; 26: 203-213.
[51] Fragasso G, Lu C, Dabrowski P, Pagnotta P, Sheiban I and Chierchia SL. Comparison of stress/rest myocardial perfusion tomography, dipyridamole and dobutamine stress echocardiography for the detection of coronary disease in hypertensive patients with chest pain and positive exercise test. J Am Coll Cardiol 1999; 34: 441-447.
[52] Gallowitsch HJ, Sykora J, Mikosch P, Kresnik E, Unterweger O, Molnar M, Grimm G and Lind P. Attenuation-corrected thallium-201 single-photon emission tomography using a gadolinium-153 moving line source: clinical value and the impact of attenuation correction on the extent and severity of perfusion abnormalities. Eur J Nucl Med 1998; 25: 220-228.
[53] Gentile R, Vitarelli A, Schillaci O, Lagana B, Gianni C, Rossi-Fanelli F and Fedele F. Diagnostic accuracy and prognostic implications of stress testing for coronary artery disease in the elderly. Ital Heart J 2001; 2: 539-545.
[54] Gonzalez P, Massardo T, Jofre MJ, Yovanovich J, Prat H, Munoz A, Arriagada M, Anzoategui W and Carmona AR. 201Tl myocardial SPECT detects significant coronary artery disease between 50% and 75% angiogram stenosis. Rev Esp Med Nucl 2005; 24: 305-311.
[55] Grossman GB, Garcia EV, Bateman TM, Heller GV, Johnson LL, Folks RD, Cullom SJ, Galt JR, Case JA, Santana CA and Halkar RK. Quantitative Tc-99m sestamibi attenuation-corrected SPECT: development and multicenter trial validation of myocardial perfusion stress gender-independent normal database in an obese population. J Nucl Cardiol 2004; 11: 263-272.
[56] Groutars RG, Verzijlbergen JF, Tiel-van Buul MM, Zwinderman AH, Ascoop CA, van Hemel NM and van der Wall EE. The accuracy of 1-day dual-isotope myocardial SPECT in a population with high prevalence of coronary artery disease. Int J Cardiovasc Imaging 2003; 19: 229-238.
[57] Grover-McKay M, Milne N, Atwood JE and Lyons KP. Comparison of thallium-201 single-photon emission computed tomographic scintigraphy with intravenous dipyridamole and

arm exercise. Am Heart J 1994; 127: 1516-1520.

[58] Hacker M, Jakobs T, Matthiesen F, Vollmar C, Nikolaou K, Becker C, Knez A, Pfluger T, Reiser M, Hahn K and Tiling R. Comparison of spiral multidetector CT angiography and myocardial perfusion imaging in the noninvasive detection of functionally relevant coronary artery lesions: first clinical experiences. J Nucl Med 2005; 46: 1294-1300.

[59] Hambye AS, Vervaet AM and Dobbeleir AA. Head-to-head comparison of uncorrected and scatter corrected, summed and end diastolic myocardial perfusion SPECT in coronary artery disease. Nucl Med Commun 2004; 25: 347-353.

[60] Hannoush H, Shaar K, Alam S, Nasrallah A, Sawaya J and Dakik HA. Analysis of referral patterns, predictive accuracy, and impact on patient management of myocardial perfusion imaging in a new nuclear cardiology laboratory. J Nucl Cardiol 2003; 10: 148-153.

[61] He Q, Yao Z, Yu X, Qu W, Sun F, Ji F, Xu F and Qian Y. Evaluation of (99m)Tc-MIBI myocardial perfusion imaging with intravenous infusion of adenosine triphosphate in diagnosis of coronary artery disease. Chin Med J (Engl) 2002; 115: 1603-1607.

[62] He ZX, Iskandrian AS, Gupta NC and Verani MS. Assessing coronary artery disease with dipyridamole technetium-99m-tetrofosmin SPECT: a multicenter trial. J Nucl Med 1997; 38: 44-48.

[63] He ZX, Shi RF, Wu YJ, Tian YQ, Liu XJ, Wang SW, Shen R, Qin XW, Gao RL, Narula J and Jain D. Direct imaging of exercise-induced myocardial ischemia with fluorine-18-labeled deoxyglucose and Tc-99m-sestamibi in coronary artery disease. Circulation 2003; 108: 1208-1213.

[64] Hecht HS, DeBord L, Shaw R, Chin H, Dunlap R, Ryan C and Myler RK. Supine bicycle stress echocardiography versus tomographic thallium-201 exercise imaging for the detection of coronary artery disease. J Am Soc Echocardiogr 1993; 6: 177-185.

[65] Heiba SI, Hayat NJ, Salman HS, Higazy E, Sayed ME, Saleh Z, Khalaf AI, Naeem M and Bourosly S. Technetium-99m-MIBI myocardial SPECT: supine versus right lateral imaging and comparison with coronary arteriography. J Nucl Med 1997; 38: 1510-1514.

[66] Hida S, Chikamori T, Tanaka H, Igarashi Y, Hatano T, Usui Y, Miyagi M and Yamashina A. Diagnostic value of left ventricular function after adenosine triphosphate loading and at rest in the detection of multi-vessel coronary artery disease using myocardial perfusion imaging. J Nucl Cardiol 2009; 16: 20-27.

[67] Ho FM, Huang PJ, Liau CS, Lee FK, Chieng PU, Su CT and Lee YT. Dobutamine stress echocardiography compared with dipyridamole thallium-201 single-photon emission computed tomography in detecting coronary artery disease. Eur Heart J 1995; 16: 570-575.

[68] Ho YL, Wu CC, Huang PJ, Tseng WK, Lin LC, Chieng PU, Chen MF and Lee YT. Dobutamine stress echocardiography compared with exercise thallium-201 single-photon emission computed tomography in detecting coronary artery disease-effect of exercise level on accuracy. Cardiology 1997; 88: 379-385.

[69] Huang PJ, Ho YL, Wu CC, Chao CL, Chen MF, Chieng PU and Lee YT. Simultaneous dobutamine stress echocardiography and thallium-201 perfusion imaging for the detection of coronary artery disease. Cardiology 1997; 88: 556-562.

[70] Huang PJ, Yen RF, Chieng PU, Chen ML and Su CT. Do beta-blockers affect the diagnostic sensitivity of dobutamine stress thallium-201 single photon emission computed tomographic imaging? J Nucl Cardiol 1998; 5: 34-39.

[71] Hung GU, Lee KW, Chen CP, Yang KT and Lin WY. Worsening of left ventricular ejection fraction induced by dipyridamole on Tl-201 gated myocardial perfusion imaging predicts significant coronary artery disease. J Nucl Cardiol 2006; 13: 225-232.

[72] Iftikhar I, Koutelou M, Mahmarian JJ and Verani MS. Simultaneous perfusion tomography and radionuclide angiography during dobutamine stress. J Nucl Med 1996; 37: 1306-1310.

[73] Isaaz K, Afif Z, Prevot N, Cerisier A, Lamaud M, Richard L, Faure E, Granjon D, Robin C, Hassan MS, Da Costa A and Dubois F. The value of stress single-photon emission computed tomography imaging performed routinely at 6 months in asymptomatic patients for predicting angiographic restenosis after successful direct percutaneous intervention for acute ST elevation myocardial infarction. Coron Artery Dis 2008; 19: 89-97.

[74] Iskandrian AS, Heo J, Nguyen T, Beer SG, Cave V, Ogilby JD, Untereker W and Segal BL. Assessment of coronary artery disease using single-photon emission computed tomography with thallium-201 during adenosine-induced coronary hyperemia. Am J Cardiol 1991; 67: 1190-1194.

[75] Jeetley P, Hickman M, Kamp O, Lang RM, Thomas JD, Vannan MA, Vanoverschelde JL, van der Wouw PA and Senior R. Myocardial contrast echocardiography for the detection of coronary artery stenosis: a prospective multicenter study in comparison with single-photon emission computed tomography. J Am Coll Cardiol 2006; 47: 141-145.

[76] Johansen A, Hoilund-Carlsen PF, Christensen HW, Vach W, Jorgensen HB, Veje A and Haghfelt T. Diagnostic accuracy of myocardial perfusion imaging in a study population without post-test referral bias. J Nucl Cardiol 2005; 12: 530-537.

[77] Kajinami K, Seki H, Takekoshi N and Mabuchi H. Noninvasive prediction of coronary atherosclerosis by quantification of coronary artery calcification using electron beam computed tomography: comparison with electrocardiographic and thallium exercise stress test results. J Am Coll Cardiol 1995; 26: 1209-1221.

[78] Katayama T, Ogata N and Tsuruya Y. Diagnostic accuracy of supine and prone thallium-201 stress myocardial perfusion single-photon emission computed tomography to detect coronary artery disease in inferior wall of left ventricle. Ann Nucl Med 2008; 22: 317-321.

[79] Khattar RS, Senior R, Joseph D and Lahiri A. Comparison of arbutamine stress 99mTc-labeled sestamibi single-photon emission computed tomographic imaging and echocardiography for detection of the extent and severity of coronary artery disease and inducible ischemia. J Nucl Cardiol 1997; 4: 211-216.

[80] Khattar RS, Senior R and Lahiri A. Assessment of myocardial perfusion and contractile function by inotropic stress Tc-99m sestamibi SPECT imaging and echocardiography for optimal detection of multivessel coronary artery disease. Heart 1998; 79: 274-280.

[81] Kisacik HL, Ozdemir K, Altinyay E, Oguzhan A, Kural T, Kir M, Kutuk E and Goksel S. Comparison of exercise stress testing with simultaneous dobutamine stress echocardiography and technetium-99m isonitrile single-photon emission computerized tomography for diagnosis of coronary artery disease. Eur Heart J 1996; 17: 113-119.

[82] Korosoglou G, Dubart AE, DaSilva KG Jr, Labadze N, Hardt S, Hansen A, Bekeredjian R, Zugck C, Zehelein J, Katus HA and Kuecherer H. Real-time myocardial perfusion imaging for pharmacologic stress testing: added value to single photon emission computed tomography. Am Heart J 2006; 151: 131-138.

[83] Kupari M, Virtanen KS, Turto H, Viitasalo M, Manttari M, Lindroos M, Koskela E, Leinonen H, Pohjola-Sintonen S and Heikkila J. Exclusion of coronary artery disease by exercise thallium-201 tomography in patients with aortic valve stenosis. Am J Cardiol 1992; 70: 635-640.

[84] Lancellotti P, Benoit T, Rigo P and Pierard LA. Dobutamine stress echocardiography versus quantitative technetium-99m sestamibi SPECT for detecting residual stenosis and multivessel disease after myocardial infarction. Heart 2001; 86: 510-515.

[85] Lima RS, Watson DD, Goode AR, Siadaty MS, Ragosta M, Beller GA and Samady H. Incremental value of combined perfusion and function over perfusion alone by gated SPECT myocardial perfusion imaging for detection of severe three-vessel coronary artery disease. J Am Coll Cardiol 2003; 42: 64-70.

[86] Lin SL, Chiou KR, Huang WC, Peng NJ, Tsay DG and Liu CP. Detection of coronary artery disease using real-time myocardial contrast echocardiography: a comparison with dual-isotope resting thallium-201/stress technectium-99m sestamibi single-photon emission computed tomography. Heart Vessels 2006; 21: 226-235.

[87] Lipiec P, Wejner-Mik P, Krzeminska-Pakula M, Kusmierek J, Plachcinska A, Szuminski R, Peruga JZ and Kasprzak JD. Accelerated stress real-time myocardial contrast echocardiography for the detection of coronary artery disease: comparison with 99mTc single photon emission computed tomography. J Am Soc Echocardiogr 2008; 21: 941-947.

[88] Liu YB, Huang PJ, Su CT, Chieng PU, Wu CC and Ho YL. Comparison of S-T segment/heart rate slope with exercise thallium imaging and conventional S-T segment criteria in detecting coronary artery disease: effect of exercise level on accuracy. Cardiology 1998; 89: 229-234.

[89] Mahmarian JJ, Pratt CM, Cocanougher MK and Verani MS. Altered myocardial perfusion in patients with angina pectoris or silent ischemia during exercise as assessed by quantitative thallium-201 single-photon emission computed tomography. Circulation 1990; 82: 1305-1315.

[90] Mak KH, Ang ES, Goh AS, Na KX, Sundram FX and Tan AT. Myocardial perfusion imaging with technetium-99m sestamibi SPECT in the evaluation of coronary artery disease. Australas Radiol 1995; 39: 112-117.

[91] Marwick T, D'Hondt AM, Baudhuin T, Willemart B, Wijns W, Detry JM and Melin J. Optimal use of dobutamine stress for the detection and evaluation of coronary artery disease: combination with echocardiography or scintigraphy, or both? J Am Coll Cardiol 1993; 22: 159-167.

[92] Marwick TH, Lafont A, Go RT, Underwood DA, Saha GB and MacIntyre WJ. Identification of recurrent ischemia after coronary artery bypass surgery: a comparison of positron emission tomography and single photon emission computed tomography. Int J Cardiol 1992; 35: 33-41.

[93] Masood Y, Liu YH, Depuey G, Taillefer R, Araujo LI, Allen S, Delbeke D, Anstett F, Peretz A, Zito MJ, Tsatkin V and Wackers FJ. Clinical valida-

tion of SPECT attenuation correction using x-ray computed tomography-derived attenuation maps: multicenter clinical trial with angiographic correlation. J Nucl Cardiol 2005; 12: 676-686.

[94] Matsumoto N, Sato Y, Suzuki Y, Yoda S, Kunimasa T, Kato M, Tadehara F, Lewin HC, Hyun MC and Saito S. Usefulness of rapid low-dose/high-dose 1-day 99mTc-sestamibi ECG-gated myocardial perfusion single-photon emission computed tomography. Circ J 2006; 70: 1585-1589.

[95] McClellan JR, Dugan TM and Heller GV. Patterns of use and clinical utility of exercise thallium-201 single photon emission-computed tomography in a community hospital. Cardiology 1996; 87: 134-140.

[96] Melikian N, De Bondt P, Tonino P, De Winter O, Wyffels E, Bartunek J, Heyndrickx GR, Fearon WF, Pijls NH, Wijns W and De Bruyne B. Fractional flow reserve and myocardial perfusion imaging in patients with angiographic multivessel coronary artery disease. JACC Cardiovasc Interv 2010; 3: 307-314.

[97] Michaelides AP, Psomadaki ZD, Dilaveris PE, Richter DJ, Andrikopoulos GK, Aggeli KD, Stefanadis CI and Toutouzas PK. Improved detection of coronary artery disease by exercise electrocardiography with the use of right precordial leads. N Engl J Med 1999; 340: 340-345.

[98] Mohiuddin SM, Ravage CK, Esterbrooks DJ, Lucas BD Jr and Hilleman DE. The comparative safety and diagnostic accuracy of adenosine myocardial perfusion imaging in women versus men. Pharmacotherapy 1996; 16: 646-651.

[99] Montz R, Perez-Castejon MJ, Jurado JA, Martin-Comin J, Esplugues E, Salgado L, Ventosa A, Cantinho G, Sa EP, Fonseca AT and Vieira MR. Technetium-99m tetrofosmin rest/stress myocardial SPET with a same-day 2-hour protocol: comparison with coronary angiography. A Spanish-Portuguese multicentre clinical trial. Eur J Nucl Med 1996; 23: 639-647.

[100] Morishima T, Chikamori T, Hatano T, Tanaka N, Takazawa K and Yamashina A. Correlation between myocardial uptake of technetium-99m-sestamibi and pressure-derived myocardial fractional flow reserve. J Cardiol 2004; 43: 155-163.

[101] Mouden M, Ottervanger JP, Knollema S, Timmer JR, Reiffers S, Oostdijk AH, de Boer MJ and Jager PL. Myocardial perfusion imaging with a cadmium zinc telluride-based gamma camera versus invasive fractional flow reserve. Eur J Nucl Med Mol Imaging 2014; 41: 956-962.

[102] Nallamothu N, Ghods M, Heo J and Iskandrian AS. Comparison of thallium-201 single-photon emission computed tomography and electrocardiographic response during exercise in patients with normal rest electrocardiographic results. J Am Coll Cardiol 1995; 25: 830-836.

[103] Nguyen T, Heo J, Ogilby JD and Iskandrian AS. Single photon emission computed tomography with thallium-201 during adenosine-induced coronary hyperemia: correlation with coronary arteriography, exercise thallium imaging and two-dimensional echocardiography. J Am Coll Cardiol 1990; 16: 1375-1383.

[104] Nishimura S, Mahmarian JJ, Boyce TM and Verani MS. Quantitative thallium-201 single-photon emission computed tomography during maximal pharmacologic coronary vasodilation with adenosine for assessing coronary artery disease. J Am Coll Cardiol 1991; 18: 736-745.

[105] Nishiyama Y, Miyagawa M, Kawaguchi N, Nakamura M, Kido T, Kurata A, Kido T, Ogimoto A, Higaki J and Mochizuki T. Combined supine and prone myocardial perfusion single-photon emission computed tomography with a cadmium zinc telluride camera for detection of coronary artery disease. Circ J 2014; 78: 1169-1175.

[106] Ogilby JD, Iskandrian AS, Untereker WJ, Heo J, Nguyen TN and Mercuro J. Effect of intravenous adenosine infusion on myocardial perfusion and function. Hemodynamic/angiographic and scintigraphic study. Circulation 1992; 86: 887-895.

[107] Palmas W, Friedman JD, Diamond GA, Silber H, Kiat H and Berman DS. Incremental value of simultaneous assessment of myocardial function and perfusion with technetium-99m sestamibi for prediction of extent of coronary artery disease. J Am Coll Cardiol 1995; 25: 1024-1031.

[108] Patil HR, Bateman TM, McGhie AI, Burgett EV, Courter SA, Case JA and Heller GV. Diagnostic accuracy of high-resolution attenuation-corrected Anger-camera SPECT in the detection of coronary artery disease. J Nucl Cardiol 2014; 21: 127-134.

[109] Patsilinakos SP, Spanodimos S, Rontoyanni F, Kranidis A, Antonelis IP, Sotirellos K, Antonatos D, Tsaglis E, Nikolaou N and Tsigas D. Adenosine stress myocardial perfusion tomographic imaging in patients with significant aortic stenosis. J Nucl Cardiol 2004; 11: 20-25.

[110] Peltier M, Vancraeynest D, Pasquet A, Ay T, Roelants V, D'hondt AM, Melin JA, Vanoverschelde JL. Assessment of the physiologic significance of coronary disease with dipyridamole real-time myocardial contrast echocardiography. Comparison with technetium-99m sestamibi single-photon emission computed tomog-

raphy and quantitative coronary angiography. J Am Coll Cardiol 2004; 43: 257-264.
[111] Previtali M, Cannizzaro G, Lanzarini L, Calsamiglia G, Poli A and Fetiveau R. Comparison of dobutamine stress echocardiography and exercise stress Thallium-201 SPECT for detection of myocardial ischemia after acute myocardial infarction treated with thrombolysis. Int J Card Imaging 1999; 15: 195-204.
[112] Psirropoulos D, Efthimiadis A, Boudonas G, Papadopoulos I, Papadopoulos G, Ekklisiarchos D, Parthenis M, Constantinidis T and Lefkos N. Detection of myocardial ischemia in the elderly versus the young by stress thallium-201 scintigraphy and its relation to important coronary artery disease. Heart Vessels 2002; 16: 131-136.
[113] Rieber J, Jung P, Erhard I, Koenig A, Hacker M, Schiele TM, Segmiller T, Stempfle HU, Theisen K, Siebert U and Klauss V. Comparison of pressure measurement, dobutamine contrast stress echocardiography and SPECT for the evaluation of intermediate coronary stenoses. The COMPRESS trial. Int J Cardiovasc Intervent 2004; 6: 142-147.
[114] Roach PJ, Hansen PS, Scott AM, Cooper RA, Hoschl R, Wiseman JC, Bernar A and Edwards AC. Comparison of optimised planar scintigraphy with SPECT thallium, exercise ECG and angiography in the detection of coronary artery disease. Aust N Z J Med 1996; 26: 806-812.
[115] Rollan MJ, San Roman JA, Vilacosta I, Ortega JR and Bratos JL. Dobutamine stress echocardiography in the diagnosis of coronary artery disease in women with chest pain: comparison with different noninvasive tests. Clin Cardiol 2002; 25: 559-564.
[116] Rosenkranz S, Voth E, Larosee K, Baer FM, Kettering K, Smolarz K, Moka D, Schicha H, Erdmann E and Deutsch HJ. Identification of hemodynamically significant restenosis after percutaneous transluminal coronary angioplasty in acute myocardial infarction by transesophageal dobutamine stress echocardiography and comparison with myocardial single photon emission computed tomography. J Interv Cardiol 2001; 14: 271-282.
[117] Rubello D, Zanco P, Candelpergher G, Borsato N, Chierichetti F, Saitta B, Minello S and Ferlin G. Usefulness of 99mTc-MIBI stress myocardial SPECT bull's-eye quantification in coronary artery disease. Q J Nucl Med 1995; 39: 111-115.
[118] Sahiner I, Akdemir UO, Kocaman SA, Sahinarslan A, Timurkaynak T and Unlu M. Quantitative evaluation improves specificity of myocardial perfusion SPECT in the assessment of functionally significant intermediate coronary artery stenoses: a comparative study with fractional flow reserve measurements. Ann Nucl Med 2013; 27: 132-139.
[119] Sakuma H, Suzawa N, Ichikawa Y, Makino K, Hirano T, Kitagawa K and Takeda K. Diagnostic accuracy of stress first-pass contrast-enhanced myocardial perfusion MRI compared with stress myocardial perfusion scintigraphy. AJR Am J Roentgenol 2005; 185: 95-102.
[120] San Roman JA, Vilacosta I, Castillo JA, Rollan MJ, Hernandez M, Peral V, Garcimartin I, de la Torre MM and Fernandez-Aviles F. Selection of the optimal stress test for the diagnosis of coronary artery disease. Heart 1998; 80: 370-376.
[121] Santana Boado C, Candell Riera J, Aguade Bruix S, Castell Conesa J, Bermejo Fraile B, Canela Coll T, Valenzuela Juan H, Missorici M and Soler Soler J. [Quantification of myocardial ischemia in regions dependent on occluded coronary arteries in patients without previous infarction]. Rev Esp Cardiol 1998; 51: 388-395.
[122] Santoro GM, Sciagra R, Buonamici P, Consoli N, Mazzoni V, Zerauschek F, Bisi G and Fazzini PF. Head-to-head comparison of exercise stress testing, pharmacologic stress echocardiography, and perfusion tomography as first-line examination for chest pain in patients without history of coronary artery disease. J Nucl Cardiol 1998; 5: 19-27.
[123] Schaap J, Kauling RM, Boekholdt SM, Post MC, Van der Heyden JA, de Kroon TL, van Es HW, Rensing BJ and Verzijlbergen JF. Usefulness of coronary calcium scoring to myocardial perfusion SPECT in the diagnosis of coronary artery disease in a predominantly high risk population. Int J Cardiovasc Imaging 2013; 29: 677-684.
[124] Schepis T, Gaemperli O, Koepfli P, Namdar M, Valenta I, Scheffel H, Leschka S, Husmann L, Eberli FR, Luscher TF, Alkadhi H and Kaufmann PA. Added value of coronary artery calcium score as an adjunct to gated SPECT for the evaluation of coronary artery disease in an intermediate-risk population. J Nucl Med 2007; 48: 1424-1430.
[125] Schillaci O, Moroni C, Scopinaro F, Tavolaro R, Danieli R, Bossini A, Cassone R and Colella AC. Technetium-99m sestamibi myocardial tomography based on dipyridamole echocardiography testing in hypertensive patients with chest pain. Eur J Nucl Med 1997; 24: 774-778.
[126] Senior R, Lepper W, Pasquet A, Chung G, Hoffman R, Vanoverschelde JL, Cerqueira M and Kaul S. Myocardial perfusion assessment in patients with medium probability of coronary artery disease and no prior myocardial infarction: comparison of myocardial contrast echocardiography with 99mTc single-photon emis-

sion computed tomography. Am Heart J 2004; 147: 1100-1105.
[127] Senior R, Moreo A, Gaibazzi N, Agati L, Tiemann K, Shivalkar B, von Bardeleben S, Galiuto L, Lardoux H, Trocino G, Carrio I, Le Guludec D, Sambuceti G, Becher H, Colonna P, Ten Cate F, Bramucci E, Cohen A, Bezante G, Aggeli C and Kasprzak JD. Comparison of sulfur hexafluoride microbubble (SonoVue)-enhanced myocardial contrast echocardiography with gated single-photon emission computed tomography for detection of significant coronary artery disease: a large European multicenter study. J Am Coll Cardiol 2013; 62: 1353-1361.
[128] Senior R, Sridhara BS, Anagnostou E, Handler C, Raftery EB and Lahiri A. Synergistic value of simultaneous stress dobutamine sestamibi single-photon-emission computerized tomography and echocardiography in the detection of coronary artery disease. Am Heart J 1994; 128: 713-718.
[129] Shelley S, Sathyamurthy I, Madhavan, Subramanyan K, Najeeb OM and Ramachandran P. Adenosine myocardial SPECT--its efficacy and safety and correlation with coronary angiogram. J Assoc Physicians India 2003; 51: 557-560.
[130] Shin JH, Pokharna HK, Williams KA, Mehta R and Ward RP. SPECT myocardial perfusion imaging with prone-only acquisitions: correlation with coronary angiography. J Nucl Cardiol 2009; 16: 590-596.
[131] Shirai N, Yamagishi H, Yoshiyama M, Teragaki M, Akioka K, Takeuchi K, Yoshikawa J and Ochi H. Incremental value of assessment of regional wall motion for detection of multivessel coronary artery disease in exercise (201)Tl gated myocardial perfusion imaging. J Nucl Med 2002; 43: 443-450.
[132] Slavich GA, Guerra UP, Morocutti G, Fioretti PM, Fresco C, Orlandi C, Orsolon PG, Forster T and Feruglio GA. Feasibility of simultaneous Tc99m sestamibi and 2D-echo cardiac imaging during dobutamine pharmacologic stress. Preliminary results in a female population. Int J Card Imaging 1996; 12: 113-118.
[133] Slomka PJ, Fish MB, Lorenzo S, Nishina H, Gerlach J, Berman DS and Germano G. Simplified normal limits and automated quantitative assessment for attenuation-corrected myocardial perfusion SPECT. J Nucl Cardiol 2006; 13: 642-651.
[134] Smanio PE, Carvalho AC, Tebexreni AS, Thom A, Rodrigues F, Meneghelo R, Mastrocolla L, Alves A, Piegas LS and Paola AA. Coronary artery disease in asymptomatic type-2 diabetic women. A comparative study between exercise test, cardiopulmonary exercise test, and dipyridamole myocardial perfusion scintigraphy in the identification of ischemia. Arq Bras Cardiol 2007; 89: 263-269, 290-267.
[135] Smart SC, Bhatia A, Hellman R, Stoiber T, Krasnow A, Collier BD and Sagar KB. Dobutamine-atropine stress echocardiography and dipyridamole sestamibi scintigraphy for the detection of coronary artery disease: limitations and concordance. J Am Coll Cardiol 2000; 36: 1265-1273.
[136] Soman P, Khattar R, Senior R and Lahiri A. Inotropic stress with arbutamine is superior to vasodilator stress with dipyridamole for the detection of reversible ischemia with Tc-99m sestamibi single-photon emission computed tomography. J Nucl Cardiol 1997; 4: 364-371.
[137] Srimahachota S, Limpijankit T, Boonyaratavej S, Tepmongkol S, Udayachalerm W, Suithichaiyakul T and Ngarmukos P. Detection of restenosis after percutaneous transluminal coronary angioplasty using the exercise treadmill test and technetium 99m-sestamibi scintigraphy. J Med Assoc Thai 2001; 84: 307-313.
[138] Stewart RE, Schwaiger M, Molina E, Popma J, Gacioch GM, Kalus M, Squicciarini S, al-Aouar ZR, Schork A and Kuhl DE. Comparison of rubidium-82 positron emission tomography and thallium-201 SPECT imaging for detection of coronary artery disease. Am J Cardiol 1991; 67: 1303-1310.
[139] Suzuki Y, Slomka PJ, Wolak A, Ohba M, Suzuki S, De Yang L, Germano G and Berman DS. Motion-frozen myocardial perfusion SPECT improves detection of coronary artery disease in obese patients. J Nucl Med 2008; 49: 1075-1079.
[140] Tadehara F, Yamamoto H, Tsujiyama S, Hinoi T, Matsuo S, Matsumoto N, Sato Y and Kohno N. Feasibility of a rapid protocol of 1-day single-isotope rest/adenosine stress Tc-99m sestamibi ECG-gated myocardial perfusion imaging. J Nucl Cardiol 2008; 15: 35-41.
[141] Taillefer R, DePuey EG, Udelson JE, Beller GA, Benjamin C and Gagnon A. Comparison between the end-diastolic images and the summed images of gated 99mTc-sestamibi SPECT perfusion study in detection of coronary artery disease in women. J Nucl Cardiol 1999; 6: 169-176.
[142] Taillefer R, DePuey EG, Udelson JE, Beller GA, Latour Y and Reeves F. Comparative diagnostic accuracy of Tl-201 and Tc-99m sestamibi SPECT imaging (perfusion and ECG-gated SPECT) in detecting coronary artery disease in women. J Am Coll Cardiol 1997; 29: 69-77.
[143] Takeishi Y, Takahashi N, Fujiwara S, Atsumi H, Takahashi K and Tomoike H. Myocardial tomography with technetium-99m-tetrofosmin during intravenous infusion of adenosine triphosphate. J Nucl Med 1998; 39: 582-586.

[144] Takeuchi M, Araki M, Nakashima Y and Kuroiwa A. Comparison of dobutamine stress echocardiography and stress thallium-201 single-photon emission computed tomography for detecting coronary artery disease. J Am Soc Echocardiogr 1993; 6: 593-602.
[145] Takeuchi M, Miura Y, Toyokawa T, Araki M, Nakashima Y and Kuroiwa A. The comparative diagnostic value of dobutamine stress echocardiography and thallium stress tomography for detecting restenosis after coronary angioplasty. J Am Soc Echocardiogr 1995; 8: 696-702.
[146] Takeuchi M, Sonoda S, Miura Y and Kuroiwa A. Comparative diagnostic value of dobutamine stress echocardiography and stress thallium-201 single-photon-emission computed tomography for detecting coronary artery disease in women. Coron Artery Dis 1996; 7: 831-835.
[147] Thompson RC, Heller GV, Johnson LL, Case JA, Cullom SJ, Garcia EV, Jones PG, Moutray KL and Bateman TM. Value of attenuation correction on ECG-gated SPECT myocardial perfusion imaging related to body mass index. J Nucl Cardiol 2005; 12: 195-202.
[148] Tsai MF, Kao PF and Tzen KY. Improved diagnostic performance of thallium-201 myocardial perfusion scintigraphy in coronary artery disease: from planar to single photon emission computed tomography imaging. Chang Gung Med J 2002; 25: 522-530.
[149] Wang FP, Amanullah AM, Kiat H, Friedman JD and Berman DS. Diagnostic efficacy of stress technetium 99m-labeled sestamibi myocardial perfusion single-photon emission computed tomography in detection of coronary artery disease among patients over age 80. J Nucl Cardiol 1995; 2: 380-388.
[150] Warner MF, Pippin JJ, DiSciascio G, Paulsen WH, Arrowood JA, Tatum JL, Goudreau E and Vetrovec GW. Assessment of thallium scintigraphy and echocardiography during dobutamine infusion for the detection of coronary artery disease. Cathet Cardiovasc Diagn 1993; 29: 122-127.
[151] Watanabe K, Sekiya M, Ikeda S, Miyagawa M, Kinoshita M and Kumano S. Comparison of adenosine triphosphate and dipyridamole in diagnosis by thallium-201 myocardial scintigraphy. J Nucl Med 1997; 38: 577-581.
[152] Wolak A, Slomka PJ, Fish MB, Lorenzo S, Acampa W, Berman DS and Germano G. Quantitative myocardial-perfusion SPECT: comparison of three state-of-the-art software packages. J Nucl Cardiol 2008; 15: 27-34.
[153] Wolak A, Slomka PJ, Fish MB, Lorenzo S, Berman DS and Germano G. Quantitative diagnostic performance of myocardial perfusion SPECT with attenuation correction in women. J Nucl Med 2008; 49: 915-922.
[154] Wu MC, Chin KC, Lin KH and Chiu NT. Diagnostic efficacy of a low-dose 32-projection SPECT 99mTc-sestamibi myocardial perfusion imaging protocol in routine practice. Nucl Med Commun 2009; 30: 140-147.
[155] Yao Z, Liu XJ, Shi R, Dai R, Zhang S, Liu Y, Li S, Tian Y and Zhang X. A comparison of 99mTc-MIBI myocardial SPET with electron beam computed tomography in the assessment of coronary artery disease. Eur J Nucl Med 1997; 24: 1115-1120.
[156] Yao Z, Liu XJ, Shi RF, Dai R, Zhang S, Liu YZ, Tian YQ and Zhang XL. A comparison of 99Tcm-MIBI myocardial SPET and electron beam computed tomography in the assessment of coronary artery disease in two different age groups. Nucl Med Commun 2000; 21: 43-48.
[157] Yao ZM, Li W, Qu WY, Zhou C, He Q and Ji FS. Comparison of (99)mTc-methoxyisobutylisonitrile myocardial single-photon emission computed tomography and electron beam computed tomography for detecting coronary artery disease in patients with no myocardial infarction. Chin Med J (Engl) 2004; 117: 700-705.
[158] Yeih DF, Huang PJ and Ho YL. Enhanced diagnosis of coronary artery disease in women by dobutamine thallium-201 ST-segment/heart rate slope and thallium-201 myocardial SPECT. J Formos Med Assoc 2007; 106: 832-839.
[159] Yoon AJ, Melduni RM, Duncan SA, Ostfeld RJ and Travin MI. The effect of beta-blockers on the diagnostic accuracy of vasodilator pharmacologic SPECT myocardial perfusion imaging. J Nucl Cardiol 2009; 16: 358-367.
[160] Henzlova MJ, Cerqueira MD, Mahmarian JJ, Yao SS; Quality Assurance Committee of the American Society of Nuclear C. Stress protocols and tracers. J Nucl Cardiol 2006; 13: e80-90.

Table S1. Main characteristics of included studies

Author	Year	Country	Ethnicity	Imaging Agent	Stress	Sample Size	Outcome				Sensitivity	Specificity
							TP	FP	FN	TN		
Abramson [17]	2000	Canada	Caucasian	Tc	Or	19	9	8	0	2	100.0%	20.0%
Acampa [18]	1998	Italy	Caucasian	Tc	Exercise	32	24	1	1	6	96.0%	85.7%
Aggeli [19]	2007	Greece	Caucasian	Tl	Drug	48	24	1	6	17	80.0%	94.4%
Aksut [20]	1995	USA	Caucasian	Tl	Drug	443	358	7	40	38	89.9%	84.4%
Amanullah [21]	1993	Sweden	Caucasian	Tc	Drug	40	32	0	2	6	94.1%	100.0%
Amanullah [22]	1997	USA	Caucasian	Dual	Drug	222	159	14	12	37	93.0%	72.5%
Astarita [23]	2001	Italy	Caucasian	Tl	Exercise	53	23	16	0	14	100.0%	46.7%
Avakian [24]	2001	Brazil	Caucasian	Tl	Drug	110	13	12	18	67	41.9%	84.8%
Banzo [25]	2003	Spain	Caucasian	Tc	Dual	99	47	26	4	22	92.2%	45.8%
Banzo [25]	2003	Spain	Caucasian	Tc	Dual	99	39	14	12	34	76.5%	70.8%
Becker [26]	2015	Germany	Caucasian	Tc	Drug	424	127	59	30	208	80.9%	77.9%
Benoit [27]	1996	Belgium	Caucasian	Tc	Exercise	72	55	1	8	8	87.3%	88.9%
Berman [28]	2006	USA	Caucasian	Tc	Exercise	365	251	40	24	50	91.3%	55.6%
Berman [28]	2006	USA	Caucasian	Tc	Drug	420	252	77	28	63	90.0%	45.0%
Berman [28]	2006	USA	Caucasian	Tc	Dual	785	503	117	52	113	90.6%	49.1%
Berman [28]	2006	USA	Caucasian	Tc	Dual	290	186	9	39	56	82.7%	86.2%
Beygui [29]	2000	France	Caucasian	Tl	Exercise	179	44	25	26	84	62.9%	77.1%
Blankstein [30]	2009	USA	Caucasian	Tc	Or	34	23	3	2	6	92.0%	66.7%
Bokhari [31]	2008	USA	Caucasian	Dual	Exercise	218	116	16	27	59	81.1%	78.7%
Boomsma [32]	1998	Netherlands	Caucasian	Tc	Exercise	65	34	10	2	19	94.4%	65.5%
Borges-Neto [33]	1988	USA	Caucasian	Tc	Drug	100	77	5	7	11	91.7%	68.8%
Chammas [34]	2002	Lebanon	Asian	Tc	Exercise	58	30	6	4	18	88.2%	75.0%
Ciavolella [36]	1993	Italy	Caucasian	Tc	Exercise	197	178	3	4	12	97.8%	80.0%
Cramer [37]	1996	Netherlands	Caucasian	Tc	Drug	35	23	1	6	5	79.3%	83.3%
Daou [38]	2002	France	Caucasian	Tl	Exercise	338	167	17	98	56	63.0%	76.7%
DiBello [39]	1996	Italy	Caucasian	Tc	Drug	45	33	1	5	6	86.8%	85.7%
Dondi [40]	2004	Italy	Caucasian	Tc	Dual	130	104	6	4	16	96.3%	72.7%
Dondi [40]	2004	Italy	Caucasian	Tc	Dual	130	100	2	8	20	92.6%	90.9%
Elhendy [43]	1998	Netherlands	Caucasian	Tc	Dual	70	29	7	16	18	64.4%	72.0%
Elhendy [44]	2000	Netherlands	Caucasian	Tc	Drug	50	27	9	3	11	90.0%	55.0%
Elhendy [45]	2001	Netherlands	Caucasian	Tc	Exercise	332	183	25	57	67	76.3%	72.8%
Elhendy [42]	2006	Netherlands	Caucasian	Tc	Drug	88	44	7	9	28	83.0%	80.0%
Elhendy [41]	2006	Netherlands	Caucasian	Tc	Or	92	39	7	12	34	76.5%	82.9%
Emmett [46]	2002	Canada	Caucasian	Tc	Exercise	100	62	11	8	19	88.6%	63.3%
Esteves [47]	2014	USA	Caucasian	Tc	Or	55	36	7	3	9	92.3%	56.3%
Esteves [47]	2014	USA	Caucasian	Tc	Or	55	31	9	8	7	79.5%	43.8%
Esteves [47]	2014	USA	Caucasian	Tc	Or	55	33	4	6	12	84.6%	75.0%
Fagret [48]	1995	France	Caucasian	Tc	Drug	25	14	0	5	6	73.7%	100.0%
Ficaro [49]	1996	USA	Caucasian	Dual	Dual	60	38	6	11	5	77.6%	45.5%
Ficaro [49]	1996	USA	Caucasian	Dual	Dual	60	41	6	8	5	83.7%	45.5%
Forster [50]	2009	Germany	Caucasian	Tc	Or	72	26	10	7	29	78.8%	74.4%
Fragasso [51]	1999	Italy	Caucasian	Tc	Exercise	101	56	28	1	16	98.2%	36.4%
Gallowitsch [52]	1998	Austria	Caucasian	Tl	Exercise	68	30	10	6	22	83.3%	68.8%
Gallowitsch [52]	1998	Austria	Caucasian	Tl	Exercise	68	35	4	1	28	97.2%	87.5%
Gallowitsch [52]	1998	Austria	Caucasian	Tl	Drug	39	12	1	5	21	70.6%	95.5%
Gallowitsch [52]	1998	Austria	Caucasian	Tl	Drug	39	15	1	2	21	88.2%	95.5%
Gallowitsch [52]	1998	Austria	Caucasian	Tl	Or	107	42	11	11	43	79.2%	79.6%
Gallowitsch [52]	1998	Austria	Caucasian	Tl	Or	107	50	5	3	49	94.3%	90.7%
Gentile [53]	2001	Italy	Caucasian	Tl	Dual	132	101	11	7	13	93.5%	54.2%
George [54]	2014	USA	Caucasian	Tc	Or	381	143	50	86	102	62.4%	67.1%
Gonzalez [55]	2005	Chile	Caucasian	Tl	Dual	145	102	12	15	16	87.2%	57.1%
Grossman [56]	2004	USA	Caucasian	Tc	Exercise	74	38	25	1	10	97.4%	28.6%
Grossman [56]	2004	USA	Caucasian	Tc	Exercise	74	35	15	4	20	89.7%	57.1%
Groutars [57]	2003	Netherlands	Caucasian	Dual	Dual	123	102	6	6	9	94.4%	60.0%
Groutars [57]	2003	Netherlands	Caucasian	Dual	Dual	123	93	11	3	16	96.9%	59.3%

Grover-Mckay [58]	1994	USA	Caucasian	Tl	Drug	18	10	0	1	7	90.9%	100.0%
Hacker [59]	2005	Germany	Caucasian	Tc	Drug	50	12	9	5	24	70.6%	72.7%
Hambye [60]	2004	Belgium	Caucasian	Tc	Dual	100	60	3	26	11	69.8%	78.6%
Hambye [60]	2004	Belgium	Caucasian	Tc	Dual	100	63	3	23	11	73.3%	78.6%
Hannoush [61]	2003	Lebanon	Asian	Tc	Dual	51	40	4	1	6	97.6%	60.0%
He [62]	1997	USA	Caucasian	Tc	Drug	59	41	5	7	6	85.4%	54.5%
He [63]	2002	China	Asian	Tc	Drug	51	33	3	1	14	97.1%	82.4%
He [64]	2003	China	Asian	Tc	Exercise	26	18	0	4	4	81.8%	100.0%
Hecht [65]	1993	USA	Caucasian	Tl	Exercise	71	47	7	4	13	92.2%	65.0%
Heiba [66]	1997	Kuwait	Asian	Tc	Exercise	34	28	1	2	3	93.3%	75.0%
Hida [67]	2009	Japan	Asian	Tc	Drug	119	32	7	30	50	51.6%	87.7%
Ho [68]	1995	Taiwan	Asian	Tl	Drug	54	42	3	1	8	97.7%	72.7%
Ho [69]	1997	Taiwan	Asian	Tl	Exercise	51	29	3	9	10	76.3%	76.9%
Huang [70]	1997	Taiwan	Asian	Tl	Drug	93	60	5	7	21	89.6%	80.8%
Huang [71]	1998	Taiwan	Asian	Tl	Drug	110	53	8	12	37	81.5%	82.2%
Hung [72]	2006	Taiwan	Asian	Tl	Drug	126	75	16	6	29	92.6%	64.4%
Iftikhar [73]	1996	USA	Caucasian	Tc	Drug	38	22	1	6	9	78.6%	90.0%
Isaaz [74]	2008	France	Caucasian	Dual	Exercise	149	22	40	24	63	47.8%	61.2%
Iskandrian [75]	1991	USA	Caucasian	Tl	Drug	148	121	2	11	14	91.7%	87.5%
Jeetley [76]	2006	UK	Caucasian	Tc	Drug	123	79	13	17	14	82.3%	51.9%
Johansen [77]	2005	Denmark	Caucasian	Dual	Dual	357	94	48	32	183	74.6%	79.2%
Kajinami [78]	1995	Japan	Asian	Tl	Exercise	251	110	48	23	70	82.7%	59.3%
Katayama [79]	2008	Japan	Asian	Tl	Dual	46	17	7	5	17	77.3%	70.8%
Khattar [80]	1997	UK	Caucasian	Tc	durg	39	30	2	0	7	100.0%	77.8%
Khattar [81]	1998	UK	Caucasian	Tc	Drug	100	41	11	19	29	68.3%	72.5%
Kisacik [82]	1996	Turkey	Caucasian	Tc	Exercise	69	45	8	2	14	95.7%	63.6%
Korosoglou [83]	2006	Germany	Caucasian	Tc	-	89	48	13	14	14	77.4%	51.9%
Kupari [84]	1992	Finland	Caucasian	Tl	Or	44	21	10	0	13	100.0%	56.5%
Lancellotti [85]	2001	Belgium	Caucasian	Tc	Drug	75	48	1	21	5	69.6%	83.3%
Lima [86]	2002	USA	Caucasian	Tc	Dual	255	187	12	25	31	88.2%	72.1%
Lin [87]	2006	Taiwan	Asian	Dual	Drug	40	19	3	6	12	76.0%	80.0%
Lipiec [88]	2008	Poland	Caucasian	Tc	Drug	103	79	5	10	9	88.8%	64.3%
Liu [89]	1998	Taiwan	Asian	Tl	Exercise	90	50	10	6	24	89.3%	70.6%
Mahmarian [90]	1990	USA	Caucasian	Tl	Exercise	296	192	10	29	65	86.9%	86.7%
Mak [91]	1995	Singapore	Asian	Tc	Exercise	139	110	6	11	12	90.9%	66.7%
Marwick [92]	1992	USA	Caucasian	Tl	Drug	50	35	0	11	4	76.1%	100.0%
Marwick [93]	1993	Belgium	Caucasian	Tl	Drug	217	108	25	34	50	76.1%	66.7%
Masood [94]	2005	USA	Caucasian	Tc	Dual	118	80	14	6	18	93.0%	56.3%
Masood [94]	2005	USA	Caucasian	Tc	Dual	118	81	13	5	19	94.2%	59.4%
Masood [94]	2005	USA	Caucasian	Tc	Dual	118	60	11	26	21	69.8%	65.6%
Masood [94]	2005	USA	Caucasian	Tc	Dual	118	67	4	19	28	77.9%	87.5%
Masood [94]	2005	USA	Caucasian	Tc	Dual	118	58	7	28	25	67.4%	78.1%
Masood [94]	2005	USA	Caucasian	Tc	Dual	118	60	7	26	25	69.8%	78.1%
Matsymoto [95]	2006	Japan	Asian	Tc	Dual	56	22	1	4	29	84.6%	96.7%
McClellan [96]	1996	USA	Caucasian	Tl	Exercise	303	193	12	82	16	70.2%	57.1%
Melikian [97]	2010	Belgium	Caucasian	Tc	Drug	67	31	10	16	10	66.0%	50.0%
Michaelides [98]	1999	Greece	Caucasian	Tl	Exercise	245	196	6	15	28	92.9%	82.4%
Miller [13]	1997	USA	Caucasian	Tc	Drug	243	185	29	18	11	91.1%	27.5%
Mohiuddin [99]	1996	USA	Caucasian	Tl	Drug	202	144	6	16	36	90.0%	85.7%
Montz [100]	1996	Spain	Caucasian	Tc	Exercise	142	113	13	8	8	93.4%	38.1%
Mouden [101]	2014	Netherlands	Caucasian	Tc	Drug	100	12	19	8	61	60.0%	76.3%
Nallamothu [102]	1995	USA	Caucasian	Tl	Exercise	321	216	17	51	37	80.9%	68.5%
Nguyen [103]	1990	USA	Caucasian	Tl	Drug	60	49	0	4	7	92.5%	100.0%
Nishimura [104]	1991	USA	Caucasian	Tl	Drug	101	61	3	9	28	87.1%	90.3%
Nishiyama [105]	2014	Japan	Caucasian	Tc	Drug	76	47	11	7	11	87.0%	50.0%
Ogilby [106]	1992	USA	Caucasian	Tl	Drug	45	31	0	2	12	93.9%	100.0%
Ogilby [12]	1998	USA	Caucasian	Tc	Drug	26	18	0	2	6	90.0%	100.0%
Palmas [107]	1995	USA	Caucasian	Tc	Exercise	70	60	1	6	3	90.9%	75.0%

Patil [108]	2014	USA	Caucasian	Tc	Or	64	34	4	14	12	70.8%	75.0%
Patsilinakos [109]	2004	Greece	Caucasian	Tl	Drug	75	31	11	4	29	88.6%	72.5%
Peltier [110]	2004	Belgium	Caucasian	Tc	Drug	35	18	2	4	11	81.8%	84.6%
Previtali [111]	1999	Italy	Caucasian	Tl	Exercise	43	29	2	9	3	76.3%	60.0%
Psirropoulos [112]	2002	Greece	Caucasian	Tl	Exercise	301	33	136	26	106	55.9%	43.8%
Rieber [113]	2004	Germany	Caucasian	Tc	Drug	43	9	4	4	26	69.2%	86.7%
Roach [114]	1996	Australia	Caucasian	Tl	Exercise	69	38	3	15	13	71.7%	81.3%
Rollan [115]	2002	Spain	Caucasian	Tc	Drug	54	23	12	3	16	88.5%	57.1%
Rosenkranz [116]	2001	Germany	Caucasian	Tc	Drug	40	14	8	1	17	93.3%	68.0%
Rubello [117]	1995	Italy	Caucasian	Tc	Exercise	120	98	5	9	8	91.6%	61.5%
Rubello [117]	1995	Italy	Caucasian	Tc	Exercise	120	100	5	7	8	93.5%	61.5%
Sahiner [118]	2013	Turkey	Caucasian	Tl	Drug	58	8	5	5	40	61.5%	88.9%
Sakuma [119]	2005	Japan	Asian	Tl	Dual	40	17	7	4	12	81.0%	63.2%
San Roman [120]	1998	Spain	Caucasian	Tc	Drug	92	54	9	8	21	87.1%	70.0%
Santana-Boado [121]	1998	Spain	Caucasian	Tc	Dual	163	88	7	8	60	91.7%	89.6%
Santoro [122]	1998	Italy	Caucasian	Tc	Drug	60	32	3	1	24	97.0%	88.9%
Santoro [122]	1998	Italy	Caucasian	Tc	Drug	60	30	5	3	22	90.9%	81.5%
Schaap [123]	2013	Netherlands	Caucasian	Tc	Or	98	52	9	4	33	92.9%	78.6%
Schepis [124]	2007	Switzerland	Caucasian	Tc	Drug	77	32	3	10	32	76.2%	91.4%
Schillaci [125]	1997	Italy	Caucasian	Tc	Drug	40	21	5	1	13	95.5%	72.2%
Senior [126]	1994	UK	Caucasian	Tc	Drug	61	42	5	2	12	95.5%	70.6%
Senior [127]	2004	USA	Caucasian	Tc	Drug	55	21	1	22	11	48.8%	91.7%
Senior [128]	2013	UK	Caucasian	Tc	Drug	516	79	69	82	286	49.1%	80.6%
Shelley [129]	2003	India	Asian	Tc	Drug	108	64	8	0	36	100.0%	81.8%
Shin [130]	2009	USA	Caucasian	Dual	Drug	246	140	34	19	53	88.1%	60.9%
Shirai [131]	2002	Japan	Asian	Tl	Exercise	603	106	13	131	353	44.7%	96.4%
Slavich [132]	1996	Italy	Caucasian	Tc	Drug	46	18	4	4	20	81.8%	83.3%
Slomaka [133]	2006	USA	Caucasian	Tc	Dual	174	115	7	22	30	83.9%	81.1%
Slomaka [133]	2006	USA	Caucasian	Tc	Dual	174	117	10	20	27	85.4%	73.0%
Smanio [134]	2007	Brazil	Caucasian	Tc	Drug	104	32	4	2	66	94.1%	94.3%
Smart [135]	2000	USA	Caucasian	Tc	Drug	183	95	17	24	47	79.8%	73.4%
Soman [136]	1997	UK	Caucasian	Tc	durg	27	21	2	0	4	100.0%	66.7%
Soman [136]	1997	UK	Caucasian	Tc	Drug	27	19	2	2	4	90.5%	66.7%
Srimahachota [137]	2001	Thailand	Asian	Tc	Exercise	46	23	5	4	14	85.2%	73.7%
Stewart [138]	1991	USA	Caucasian	Tl	Or	81	50	10	10	11	83.3%	52.4%
Suzuki [139]	2008	USA	Caucasian	Dual	Dual	90	58	5	5	22	92.1%	81.5%
Tadehara [140]	2008	Japan	Asian	Tc	Drug	101	50	14	4	33	92.6%	70.2%
Taillefer [141]	1997	Canada	Caucasian	Tl	Exercise	48	24	8	8	8	75.0%	50.0%
Taillefer [141]	1997	Canada	Caucasian	Tc	Exercise	48	23	3	9	13	71.9%	81.3%
Taillefer [141]	1997	Canada	Caucasian	Tl	Drug	37	24	0	8	5	75.0%	100.0%
Taillefer [141]	1997	Canada	Caucasian	Tc	Drug	37	23	0	9	5	71.9%	100.0%
Taillefer [141]	1997	Canada	Caucasian	Tl	Exercise	48	22	10	6	10	78.6%	50.0%
Taillefer [141]	1997	Canada	Caucasian	Tc	Exercise	48	21	3	7	17	75.0%	85.0%
Taillefer [141]	1997	Canada	Caucasian	Tl	Exercise	37	21	4	2	10	91.3%	71.4%
Taillefer [141]	1997	Canada	Caucasian	Tc	Drug	37	20	3	3	11	87.0%	78.6%
Taillefer [141]	1997	Canada	Caucasian	Tl	Drug	85	48	8	16	13	75.0%	61.9%
Taillefer [141]	1997	Canada	Caucasian	Tc	Or	85	46	3	18	18	71.9%	85.7%
Taillefer [141]	1997	Canada	Caucasian	Tl	Or	85	43	14	8	20	84.3%	58.8%
Taillefer [141]	1997	Canada	Caucasian	Tc	Or	85	41	6	10	28	80.4%	82.4%
Taillefer [142]	1999	USA	Caucasian	Tc	Or	53	28	2	10	13	73.7%	86.7%
Takeishi [143]	1998	Japan	Asian	Tc	Drug	65	39	4	5	17	88.6%	81.0%
Takeuchi [144]	1993	Japan	Asian	Tl	Or	120	66	7	8	39	89.2%	84.8%
Takeuchi [145]	1995	Japan	Asian	Tl	Or	52	17	2	6	27	73.9%	93.1%
Takeuchi [146]	1996	Japan	Asian	Tl	Or	61	14	13	4	30	77.8%	69.8%
Thompsom [147]	2005	USA	Caucasian	Tc	Dual	116	78	14	10	14	88.6%	50.0%
Thompsom [147]	2005	USA	Caucasian	Tc	Dual	116	76	6	12	22	86.4%	78.6%
Tsai [148]	2002	Taiwan	Asian	Tl	Exercise	86	60	11	3	12	95.2%	52.2%
Wang [149]	1995	USA	Caucasian	Tl	Or	75	55	2	8	10	87.3%	83.3%

Warner [150]	1993	China	Asian	Tl	Drug	16	14	0	1	1	93.3%	100.0%
Watanabe [151]	1997	Japan	Asian	Tl	Drug	70	34	8	7	21	82.9%	72.4%
Watanabe [151]	1997	Japan	Asian	Tl	Drug	70	40	3	6	21	87.0%	87.5%
Watanabe [151]	1997	Japan	Asian	Tl	Drug	140	74	11	13	42	85.1%	79.2%
Wolak [152]	2008	USA	Caucasian	Tc	Dual	114	55	12	14	33	79.7%	73.3%
Wolak [153]	2008	USA	Caucasian	Tc	Dual	114	56	12	13	33	81.2%	73.3%
Wolak [153]	2008	USA	Caucasian	Tc	Drug	188	124	13	19	32	86.7%	71.1%
Wu [154]	2009	Taiwan	Asian	Tc	Drug	218	123	33	7	55	94.6%	62.5%
Yao [155]	1997	China	Asian	Tc	Exercise	51	34	1	2	14	94.4%	93.3%
Yao [156]	2000	China	Asian	Tc	Exercise	64	42	1	3	18	93.3%	94.7%
Yao [157]	2004	China	Asian	Tc	Exercise	73	28	3	7	35	80.0%	92.1%
Yeih [158]	2007	Taiwan	Asian	Tl	Drug	51	20	3	8	20	71.4%	87.0%
Yoon [159]	2009	USA	Caucasian	Tc	Drug	344	191	83	28	42	87.2%	33.6%

TP: true positive, FP: false positive, FN: false negative, TN: true negative; Tc: technetium-99m, T1: thallium-201, Dual: technetium-99m + thallium-201. There are 145 articles with 184 studies included in this meta-analysis.

Table S2. QUADAS-2

QUADAS-2 studid	Risk of Bias				Applicability			Qscore
	(1) subjbias	(2) testbias	(3) refbias	(4) diagbias	(5) subjapp	(6) testapp	(7) refapp	
Abramson, 2000	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	6
Acampa, 1998	Yes	Unclear	Yes	Unclear	Yes	Yes	Yes	5
Aggeli, 2007	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Aksut, 1995	Yes	Yes	Yes	Yes	No	Yes	Yes	6
Amanullah, 1993	Yes	Unclear	Yes	Yes	Yes	Unclear	Yes	5
Amanullah, 1997	Yes	No	Yes	No	Yes	Yes	Yes	5
Astarita, 2001	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Avakian, 2001	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	6
Banzo, 2003	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Banzo, 2003	Yes	No	Yes	Unclear	Yes	Yes	Yes	5
Becker, 2015	Unclear	Yes	Yes	Yes	Yes	Unclear	Yes	5
Benoit, 1996	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	6
Berman, 2006	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	6
Berman, 2006	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	6
Berman, 2006	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Berman, 2006	Yes	Unclear	Yes	Yes	Yes	Unclear	Yes	5
Beygui, 2000	Yes	Yes	Yes	Yes	Yes	No	Yes	6
Blankstein, 2009	unclear	Yes	Yes	No	Yes	Yes	Yes	5
Bokhari, 2008	Yes	Unclear	Yes	Yes	No	Yes	No	4
Boomsma, 1998	Yes	Yes	Yes	Unclear	Yes	Yes	Unclear	5
Borges-Neto, 1988	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Chammas, 2002	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	6
Ciavolella, 1993	Unclear	Yes	Unclear	Yes	Yes	Yes	Yes	5
Cramer, 1996	Yes	Yes	Yes	Unclear	Unclear	Yes	Yes	5
Daou, 2002	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	6
DiBello, 1996	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Dondi, 2004	Unclear	Yes	Unclear	Yes	Unclear	Yes	Yes	4
Dondi, 2004	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Elhendy, 1998	Yes	Unclear	Yes	Unclear	Yes	Unclear	Yes	4
Elhendy, 2000	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Elhendy, 2001	Yes	Yes	Yes	Yes	No	No	Unclear	4
Elhendy, 2006	Unclear	Unclear	Yes	Yes	Yes	Yes	Unclear	4

Elhendy, 2006	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	6
Emmett, 2002	Unclear	Yes	Unclear	Yes	Yes	Yes	Yes	5
Esteves, 2014	Yes	No	Yes	Yes	Yes	Yes	Unclear	5
Esteves, 2014	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	6
Esteves, 2014	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	6
Fagret, 1995	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	6
Ficaro, 1996	Yes	Yes	Yes	No	Yes	Yes	Yes	6
Ficaro, 1996	Yes	Unclear	Yes	Yes	Yes	Unclear	Yes	5
Forster, 2009	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Fragasso, 1999	Yes	Yes	Unclear	Yes	Unclear	Yes	Yes	5
Gallowitsch, 1998	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	5
Gallowitsch, 1998	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	6
Gallowitsch, 1998	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	5
Gallowitsch, 1998	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Gallowitsch, 1998	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	6
Gallowitsch, 1998	Yes	Yes	No	No	No	Yes	Yes	4
Gentile, 2001	Yes	Yes	No	Unclear	Yes	Unclear	Yes	4
George, 2014	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Gonzalez, 2005	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Grossman, 2004	unclear	Yes	Yes	Yes	Yes	Yes	Yes	6
Grossman, 2004	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	6
Groutars, 2003	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	6
Groutars, 2003	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	6
Grover-Mckay, 1994	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Hacker, 2005	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	6
Hambye, 2004	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear	5
Hambye, 2004	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	6
Hannoush, 2003	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	6
He, 1997	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	6
He, 2002	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
He, 2003	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Hecht, 1993	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	6
Heiba, 1997	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Hida, 2009	Yes	Yes	Yes	No	Yes	Yes	Yes	6
Ho, 1995	Yes	No	Yes	Yes	Yes	Yes	Yes	6
Ho, 1997	Yes	No	Yes	Yes	Yes	Yes	Yes	6
Huang, 1997	Yes	Yes	Yes	Yes	Yes	No	Yes	6
Huang, 1998	Yes	Yes	Yes	No	Yes	Yes	Yes	6
Hung, 2006	Unclear	Unclear	Yes	Yes	Unclear	Yes	Yes	4
Iftikhar, 1996	Yes	Unclear	Yes	Yes	Yes	Unclear	Unclear	4
Isaaz, 2008	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Iskandrian, 1991	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	6
Jeetley, 2006	Unclear	Yes	Yes	No	Yes	Unclear	Yes	4
Johansen, 2005	Yes	No	Yes	Yes	Yes	Yes	Yes	6
Kajinami, 1995	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Katayama, 2008	Yes	Yes	Unclear	Yes	No	Yes	Yes	5
Khattar, 1997	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	6
Khattar, 1998	Yes	Yes	No	Yes	Yes	Yes	Yes	6
Kisacik, 1996	Yes	No	Yes	Yes	Unclear	Yes	Yes	5
Korosoglou, 2006	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7

Kupari, 1992	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Lancellotti, 2001	Yes	Yes	Unclear	Unclear	Yes	Yes	Unclear	4
Lima, 2002	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Lin, 2006	Yes	No	Yes	Unclear	No	Yes	Yes	4
Lipiec, 2008	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	6
Liu, 1998	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	6
Mahmarian, 1990	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Mak, 1995	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	6
Marwick, 1992	Yes	Yes	Yes	Yes	Yes	No	Unclear	5
Marwick, 1993	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	6
Masood, 2005	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Masood, 2005	Unclear	Yes	Yes	Yes	Yes	Yes	Unclear	5
Masood, 2005	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Masood, 2005	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	6
Masood, 2005	Unclear	Yes	No	Yes	Yes	Yes	Yes	5
Masood, 2005	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Matsymoto, 2006	Yes	Yes	Yes	Yes	Yes	No	Yes	6
McClellan, 1996	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	6
Melikian, 2010	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	6
Michaelides, 1999	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Miller, 1997	Yes	Yes	Yes	Yes	Yes	No	Yes	6
Mohiuddin, 1996	Yes	No	Yes	Yes	Yes	Yes	Yes	6
Montz, 1996	Yes	No	Yes	Yes	Unclear	Yes	Yes	5
Mouden, 2014	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Nallamothu, 1995	Yes	Yes	Yes	Yes	Yes	No	Yes	6
Nguyen, 1990	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	6
Nishimura, 1991	Unclear	No	Yes	Yes	Yes	Yes	Yes	5
Nishiyama, 2014	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	6
Ogilby, 1992	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	6
Ogilby, 1998	Yes	Yes	No	Yes	Yes	Yes	Yes	6
Palmas, 1995	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	6
Patil, 2014	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	6
Patsilinakos, 2004	Unclear	Yes	Yes	Yes	No	Yes	Yes	5
Peltier, 2004	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear	5
Previtali, 1999	unclear	Yes	Yes	Yes	No	Yes	Yes	5
Psirropoulos, 2002	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Rieber, 2004	Yes	Yes	Unclear	Yes	Yes	Unclear	Yes	5
Roach, 1996	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Rollan, 2002	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	6
Rosenkranz, 2001	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	6
Rubello, 1995	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Rubello, 1995	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Sahiner, 2013	unclear	Yes	Yes	Yes	Yes	Yes	Yes	6
Sakuma, 2005	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	6
San Roman, 1998	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Santana-Boado, 1998	Yes	No	Yes	Yes	Yes	Yes	Yes	6
Santoro, 1998	Yes	No	Yes	Unclear	Yes	Unclear	Yes	4
Santoro, 1998	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Schaap, 2013	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	6
Schepis, 2007	Yes	Yes	Yes	Yes	No	Yes	Yes	6
Schillaci, 1997	Unclear	Yes	Yes	Yes	No	Yes	Yes	5

Senior, 1994	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Senior, 2004	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Senior, 2013	No	Yes	Yes	Yes	Yes	Yes	Yes	6
Shelley, 2003	Yes	No	Yes	Yes	Yes	Yes	Yes	6
Shin, 2009	Yes	Yes	Yes	Unclear	Unclear	Yes	Yes	5
Shirai, 2002	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Slavich, 1996	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	6
Slomaka, 2006	Yes	Yes	Yes	Yes	No	Yes	Yes	6
Slomaka, 2006	Yes	No	Yes	Yes	Yes	Yes	Yes	6
Smanio, 2007	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	6
Smart, 2000	Unclear	Unclear	Yes	Yes	Yes	Yes	Yes	5
Soman, 1997	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Soman, 1997	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	6
Srimahachota, 2001	Yes	Unclear	Yes	Yes	No	Unclear	Yes	4
Stewart, 1991	Yes	Yes	Yes	Yes	unclear	Yes	Yes	6
Suzuki, 2008	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Tadehara, 2008	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	6
Taillefer, 1997	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	6
Taillefer, 1997	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Taillefer, 1997	Yes	Unclear	Yes	Yes	Yes	Unclear	Yes	5
Taillefer, 1997	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Taillefer, 1997	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Taillefer, 1997	No	No	Yes	Yes	Yes	Yes	Yes	5
Taillefer, 1997	Yes	No	Yes	Yes	Yes	Yes	Yes	6
Taillefer, 1997	Yes	No	Yes	Yes	No	Yes	Yes	5
Taillefer, 1997	Yes	Yes	Yes	No	Yes	Yes	Yes	6
Taillefer, 1997	No	Unclear	Yes	Yes	Yes	Yes	Yes	5
Taillefer, 1997	Yes	Yes	No	Yes	Yes	No	Yes	5
Taillefer, 1997	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Taillefer, 1999	Yes	Yes	Yes	Yes	No	Yes	Yes	6
Takeishi, 1998	Yes	Yes	Yes	No	Yes	Yes	No	5
Takeuchi, 1993	Unclear	Yes	Yes	Yes	Yes	No	Yes	5
Takeuchi, 1995	Yes	Yes	Unclear	No	Yes	Yes	Unclear	4
Takeuchi, 1996	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Thompsom, 2005	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	6
Thompsom, 2005	No	Unclear	No	Yes	Unclear	Yes	Yes	3
Tsai, 2002	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Wang, 1995	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Warner, 1993	Yes	No	Yes	No	Yes	Yes	Yes	5
Watanabe, 1997	Yes	Yes	Yes	Yes	No	Yes	No	5
Watanabe, 1997	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Watanabe, 1997	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Wolak, 2008	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Wolak, 2008	Yes	No	Yes	Yes	No	Yes	Yes	5
Wolak, 2008	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	6
Wu, 2009	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	6
Yao, 1997	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	6
Yao, 2000	Yes	Yes	Yes	Yes	No	Yes	Yes	6
Yao, 2004	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	6
Yeih, 2007	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	6
Yoon, 2009	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	6