Safety of and Tolerance to Adenosine Infusion for Myocardial Perfusion Single-Photon Emission Computed Tomography in a Japanese Population

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Background  Adenosine has been available for use in myocardial perfusion single-photon emission computed tomography (SPECT) in Japan since 2005. The purpose of this study was to evaluate the safety of and tolerance to thallium-201 myocardial perfusion SPECT with intravenous adenosine infusion in Japanese patients with suspected coronary artery disease.

Methods and Results  Two hundred and six consecutive patients who underwent an adenosine infusion (120μg·kg⁻¹·min⁻¹) SPECT at Sumitomo Besshi Hospital (Niihama, Japan) were investigated. The effects of adenosine infusion were monitored for each patient. A coronary angiography was performed in 81 patients. Adenosine infusion significantly decreased blood pressure and increased heart rate. Adverse reactions were observed in 161 patients (78.2%). Most reactions were transient, disappearing soon after the termination of adenosine infusion. No serious adverse reactions, such as acute myocardial infarction or death, occurred. Adenosine infusion was terminated in 3 patients (1.5%) because of near syncope or sustained 2:1 atrioventricular block. Electrocardiographic changes occurred in 15 patients (7.3%). Self-assessed scoring after SPECT showed that the patients were very tolerant (74.6% of 177 patients) of adenosine infusion myocardial SPECT. The sensitivity and specificity were 75.0% and 69.7%, respectively.

Conclusions  Adenosine infusion myocardial SPECT is safe and well tolerated in the Japanese population, despite the frequent occurrence of minor adverse reactions. (Circ J 2007; 71: 904–910)

Key Words:  Adenosine; Coronary heart disease; Japanese; Pharmacologic stress

Pharmacologic coronary vasodilation in combination with single-photon emission computed tomography (SPECT) is a safe and effective method for the diagnosis of coronary artery disease. Dipyridamole in conjunction with thallium imaging has been widely used as an alternative to exercise for patients unable to perform adequate exercise stress testing. However, side-effects caused by dipyridamole administration are frequent and can be life-threatening, because of its prolonged pharmacologic effect (15–30 min when administered intravenously), and it is often necessary to eliminate side-effects with intravenous aminophylline infusion. Dipyridamole is thought to be an indirect coronary vasodilator, and it acts by blocking the cellular uptake of the primary vasodilator, adenosine, and leads to subsequent increases in myocardial and arteriolar wall adenosine concentrations. Thallium-201 myocardial perfusion SPECT with adenosine has recently been introduced in Japan. Compared to dipyridamole, the side-effects of adenosine are also frequent but are mild, transient and well tolerated and do not require aminophylline administration because the plasma half-life of adenosine is exceedingly short (2–10 s) and its effects disappear promptly upon discontinuation of adenosine infusion. The short half-life of adenosine and the ability to regulate its infusion rate are useful properties, allowing for easy control of pharmacologic coronary vasodilation. However, adenosine is a very potent arteriolar vasodilator that can cause myocardial ischemia via a coronary steal phenomenon and can also decrease atrioventricular (AV) node conduction velocity.

In this study, we assessed the safety of and tolerance to thallium-201 myocardial perfusion SPECT with intravenous adenosine infusion in Japanese patients with suspected coronary artery disease.

Methods

Patients  During the period September 2005 to July 2006, 206 consecutive Japanese patients (106 men, 100 women; mean age, 68.9±10.5 years; range, 33–89 years) underwent thallium-201 myocardial perfusion SPECT with intravenous adenosine infusion for the evaluation of possible coronary artery disease. The research protocol was approved by the Institutional Review Board of the Sumitomo Besshi Hospital (Niihama, Japan), and patients were enrolled in the study after providing written informed consent. Exclusion criteria included hypotension (systolic blood pressure <90mmHg),...
New York Heart Association Class III or IV congestive heart failure, greater than first-degree AV block, history of asthma or severe chronic obstructive pulmonary disease requiring bronchodilators or steroids, use of dipryidamole or theophylline within the last 24 h and use of caffeine within the last 12 h. SPECT was performed after patients had fasted for at least 12 h. Indications for SPECT were as follows: assessment of chest pain (47.6%; 39.3% typical and 8.3% atypical for angina pectoris), assessment of other symptoms (shortness of breath, dyspnea, palpitation, syncope) (12.6%), evaluation of ischemia for percutaneous coronary intervention and risk stratification late after myocardial infarction (18.0%), and screening for coronary artery disease (including ECG abnormalities, asymptomatic, evaluation before a surgical procedure) (21.8%).

**Adenosine Infusion Protocol and Measurement of Clinical Variables**

We used a single-port infusion system composed of a primary intravenous (iv) setup of normal saline solution, which was infused by gravity and attached to a 3-way stopcock that connected directly to the iv catheter needle in the peripheral antecubital vein (Fig 1). Adenosine was infused with the use of an accurate computerized infusion pump system for 6 min at a constant rate of 120 μg·kg⁻¹·min⁻¹. At the midpoint of the infusion, the radiotracer (111 MBq thallium-201) was injected as a bolus and subsequently flushed with normal saline solution. Patients were observed carefully and continuously throughout the study. Systolic and diastolic blood pressure, heart rate and 12-lead electrocardiograms (ECGs) were recorded at baseline, during each min of infusion, at the time of administration of the radiotracer and for at least 3 min after adenosine infusion. During infusion, 12-lead ECGs were monitored continuously. An ischemic response was defined as either 21-mm flat or downsloping ST-segment depression or ≥1.5-mm upsloping ST-segment depression in 2 or more contiguous leads at 80 ms from the J point. Symptoms and adverse events were recorded throughout the procedure. After SPECT, patients were surveyed regarding subjective symptoms. Patients evaluated the intensity of their symptoms as mild, moderate or severe discomfort. In addition, tolerance was also evaluated on a scale of 1 to 5, in which 1 was no discomfort and 5 was severe discomfort.

**SPECT Imaging**

Thallium-201 myocardial perfusion SPECT was performed after the completion of adenosine infusion, and redistribution images were obtained 3 h later. Image quality was generally good. Image slices were analyzed visually by 3 experienced nuclear cardiologists who were unaware of the electrocardiographic or coronary angiographic findings. An image was considered abnormal if there was a decrease of thallium-201 uptake in any of the myocardial segments by visual inspection. The presence or absence of redistribution was noted visually in the 3-h images. Myocardial segments and the 3 major coronary arteries were matched as follows: (1) the septal and anterior segments corresponded to the left anterior descending coronary artery; (2) the inferior and posterior segments corresponded to the right coronary artery; and (3) the lateral segments corresponded to the left circumflex coronary artery. Pure apical defects were considered abnormal but were not assigned to any individual coronary vessel. SPECT images were also quantified by the same 3 observers who used computerized 2-dimensional (D) polar (bull’s-eye) maps to depict 3-D myocardial radioactivity; the final determinations of abnormality and location were at the interpreter’s discretion.

We determined the interobserver and intraobserver reproducibility in our laboratory for detecting the area and grade of thallium-201 uptake in 20 randomly selected patients. The interobserver reproducibility was determined by a second experienced observer who independently re-interpreted the images. The intraobserver reproducibility was determined by the original interpreter who reanalyzed the images at least 1 month after the original readings were taken. The interobserver and intraobserver concordance rates for visual analysis of thallium-201 SPECT images were 90% and 95%, respectively.

**Coronary Angiography**

Selective coronary angiography with multiple views was performed with standard techniques. The decision to perform a coronary angiography was made at the discretion of each patient’s primary physician. Of the 206 patients enrolled in the study, 81 (49 men, 32 women; mean age, 69.9±8.6 years) underwent a coronary angiography within 1 month of an adenosine thallium-201 perfusion SPECT. Coronary stenoses in the 3 major coronary arteries were measured with calipers by an experienced angiographer and expressed as a percent of the luminal diameter stenosis. All angiograms were interpreted by 3 experienced angiographers blinded to the knowledge of the adenosine SPECT results, and lesions with a diameter stenosis >50% were...
considered significant.\textsuperscript{11}  
Our interobserver reproducibility for measuring the angiographic severity of stenoses was analyzed with 20 randomly selected samples. Interobserver error in our laboratory was 5%.

**Statistical Analysis**  
Data are expressed as mean $\pm$ SD. The Student’s t-test was used for comparison. A $p$-value $<0.05$ was considered statistically significant.

**Results**

**Patient Characteristics**  
Clinical characteristics of the 206 enrolled patients are summarized in Table 1. Among the patients examined in this study, 39 (18.9%) had a previous myocardial infarction, 65 (31.6%) had undergone a previous percutaneous coronary intervention, and 12 (5.8%) had undergone coronary artery bypass grafting. With respect to medication, 38 patients (18.4%) were currently using nitrates, 46 (22.3%) were using a $\beta$-adrenergic blocking agent, 72 (35.0%) were using a calcium channel antagonist, 83 (40.3%) were using an angiotensin receptor blocker or an angiotensin-converting enzyme inhibitor, and 68 (33.0%) were using statins.

**Hemodynamic Effects of Adenosine**  
Hemodynamic effects of intravenous adenosine infusion are summarized in Table 2 and Fig 2. The mean baseline heart rate increased significantly during adenosine infusion, whereas 12 patients (5.8%) showed no change, and 23 (11.2%) showed a decrease in heart rate. Adenosine infu-

\begin{table}[h]
\centering
\begin{tabular}{|l|c|}
\hline
\textbf{Age (years $\pm$ SD)} & 68.9$\pm$10.5 \\
\textbf{Sex (M/F)} & 106/100 \\
\textbf{Weight (kg $\pm$ SD)} & 59.8$\pm$12.2 \\
\textbf{Coronary artery disease} & 82 (39.8) \\
\textbf{Previous myocardial infarction} & 39 (18.9) \\
\textbf{Previous coronary intervention} & 65 (31.6) \\
\textbf{Previous coronary artery bypass graft} & 12 (5.8) \\
\textbf{Hypertension} & 128 (62.1) \\
\textbf{Diabetes mellitus} & 65 (31.6) \\
\textbf{Hyperlipidemia} & 112 (54.4) \\
\textbf{Metabolic syndrome} & 45 (21.8) \\
\textbf{Family history} & 76 (36.9) \\
\textbf{Currently smoking} & 24 (11.7) \\
\textbf{Nitrates} & 38 (18.4) \\
\textbf{$\beta$-blockers} & 46 (22.3) \\
\textbf{Calcium antagonists} & 72 (35.0) \\
\textbf{ARB/ACE-I} & 83 (40.3) \\
\textbf{Statins} & 68 (33.0) \\
\hline
\end{tabular}
\caption{Patient Characteristics}
\end{table}

Values are number (%).

\begin{table}[h]
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\begin{tabular}{|l|c|c|c|}
\hline
\textbf{} & \textbf{Baseline} & \textbf{Peak effect} & \textbf{p value} \\
\hline
HR (beats/min) & 66.6$\pm$11.3 & 75.6$\pm$14.1 & $<0.001$ \\
SBP (mmHg) & 151.7$\pm$24.9 & 141.3$\pm$25.8 & $<0.001$ \\
DBP (mmHg) & 85.0$\pm$14.6 & 76.1$\pm$18.3 & $<0.001$ \\
\hline
\end{tabular}
\caption{Sequential Changes in Hemodynamic Variables During Stress Test}
\end{table}

Values are mean $\pm$ SD (Student’s t-test).

Fig 2. Sequential changes in systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR) during the stress test (data are expressed as mean $\pm$ SD).

\begin{table}[h]
\centering
\begin{tabular}{|l|c|c|c|c|}
\hline
\textbf{Symptom} & \textbf{Mild} & \textbf{Moderate} & \textbf{Severe} & \textbf{Total} \\
\hline
Flushing & 36 & 11 & 2 & 49 (46.2) \\
Chest discomfort & 31 & 10 & 8 & 49 (49.0) \\
Shortness of breath & 26 & 9 & 4 & 39 (36.8) \\
Palpitation & 23 & 8 & 1 & 32 (32.0) \\
Sore throat & 20 & 5 & 0 & 25 (23.6) \\
Headache & 21 & 5 & 0 & 26 (24.5) \\
Epigastralgia & 20 & 5 & 3 & 28 (28.0) \\
\hline
\end{tabular}
\caption{Severity of Symptoms Assessed by Subject Rating (Multiple Answer)}
\end{table}

Values are number (%).
sion decreased the mean systolic and diastolic blood pressure during infusion, whereas 54 patients (26.2%) showed a paradoxical increase in systolic blood pressure, and 36 (17.5%) showed a paradoxical increase in diastolic blood pressure. In summary, adenosine infusion resulted in no significant change in rate-pressure product.

**Symptoms during Adenosine Infusion**

The side-effects during adenosine administration, as determined by patient self-assessment, are listed in Table 3. Most patients (161 of 206, 78.2%) experienced side-effects. Two or more symptoms were often observed during adenosine infusion. Flushing (47.6%), chest discomfort (46.6%) and shortness of breath (28.2%) were the most frequently reported symptoms. Chest pain was reported in 51 (24.8%) patients. Among these patients, typical chest pain, similar to the angina that they had previously experienced, occurred in 7 patients. The appearance of these side-effects occurred, for the most part, 2–3 min after the initiation of adenosine infusion, and disappearance occurred within 4 min after completion of adenosine infusion, with the exception of 1 patient who had a mild headache that lasted for 7 min after the completion of adenosine infusion (Fig 3). There was a significantly higher frequency of chest discomfort in women compared to men (p<0.05). However, the overall frequency of side-effects was not significantly different between women and men.

To compare the frequency of side-effects between younger and older patients, we analyzed the data among patients ≥75 years old (Group A; n=72), 65–74 years old (Group B; n=68) and ≤64 years old (Group C; n=66) (Table 4). Forty-seven patients in Group A (65.3%) experienced at least 1 symptom, whereas 59 in Group B (86.8%) and 55 in Group C (83.3%) experienced at least 1 symptom. Thus, the frequency of side-effects was significantly lower in elderly patients than in younger patients (p<0.05).

Three patients (1.5%) required termination of adenosine infusion (patient #56, near syncope without any change in ECG, heart rate, or blood pressure at 4 min after the initiation of adenosine infusion; patient #85, discomfort caused by sustained 2:1 AV block from 1 to 5 min after the initiation of adenosine infusion; patient #144, near syncope with a decrease in blood pressure from 134/77 mmHg to 79/45 mmHg at 5 min after the initiation of adenosine infusion).

Two patients (0.97%) required additional aminophylline therapy (patient #13, chest pain with ST-segment depression on ECG from 4 min after the initiation of adenosine infusion, aminophylline infused at 1 min after completion of adenosine infusion; patient #122, near syncope caused by complete AV block immediately after the completion of adenosine infusion but with quick recovery and aminophylline infused as a precaution).

All other symptoms were well tolerated and short lived. No serious life-threatening reactions, such as prolonged severe chest pain, bronchospasm, acute myocardial infarction or death occurred during this study.

**Electrocardiographic Alterations**

Electrocardiographic changes were observed in 15 patients (7.3%). Significant ST-segment depression occurred in 3 patients (1.5%) during adenosine infusion (patient #4, ST-segment depression without chest pain, and normal SPECT imaging; patient #13, ST-segment depression with chest pain requiring aminophylline infusion but with normal SPECT imaging; patient #31, ST-segment depression without chest pain but with abnormal SPECT imaging and significant coronary artery disease as determined by coronary angiography).

AV block was observed in 9 patients (4.4%) (2:1 AV block, Mobitz type II AV block, and complete AV block was observed in 7, 1 and 1 patient(s), respectively; Table 5).
One patient with 2:1 AV block required termination of adenosine infusion, and the patient with complete AV block was treated with aminophylline infusion. Right bundle branch block, junctional rhythm and paroxysmal supraventricular tachycardia occurred in 1 patient each, and these episodes of electrocardiographic alterations were fleeting and typically disappeared within 1 min. In general, in terms of effects of adenosine on AV conduction, adenosine infusion caused a transient prolongation of the PQ interval and QTc, but had no effect on the QRS interval of the ECG (Table 6).

Tolerance Score
Immediately after SPECT, patients evaluated their tolerance to adenosine infusion myocardial perfusion SPECT on a scale of 1 to 5, in which 1 was no discomfort and 5 was severe discomfort. Category 1 (no discomfort) comprised 74.6% of patients, and almost all patients (categories 1–3, 98.3%) reported that adenosine infusion myocardial SPECT was relatively tolerable.

Correlation Between Adenosine Infusion Myocardial SPECT and Coronary Angiography Results
Coronary angiography was performed in 81 patients (39.3%), 25 of whom had experienced previous myocardial infarction. The indication that a coronary angiography was necessary was determined by each patient’s primary physician on the basis of results from non-invasive tests, clinical risk profiles and patient preference. Of the 81 patients, 46 (56.8%) showed areas of positive redistribution, and 35 (43.2%) showed no areas of redistribution by SPECT. Forty-nine patients (60.5%) had significant coronary artery disease (33 had single-vessel disease, 14 had double-vessel disease and 2 had triple-vessel disease), and 32 (39.5%) had normal coronary arteries (data not shown). Of the 49 patients with significant coronary artery disease, 12 (24.5%) had normal thallium images, and 37 (75.5%) had reversible perfusion defects as determined by visual analysis of SPECT images (data not shown).

To assess the influence of post-test referral bias on the sensitivity and specificity of thallium-201 myocardial perfusion SPECT for detecting coronary artery disease, we separately analyzed patients who underwent thallium-201 myocardial perfusion SPECT before and after coronary angiography (Table 7). In our laboratory, specificity of patients who underwent SPECT before coronary angiography tended to be low. Sensitivity and specificity for diagnosis of coronary artery disease (>50% stenosis) are shown in Table 8. The overall sensitivity and specificity were 75.0% and 69.7%, respectively.

Discussion
In the present study, we examined the safety of and tolerance to thallium-201 myocardial perfusion SPECT with intravenous adenosine infusion in Japanese patients with suspected coronary artery disease. More than 75% of the patients experienced side-effects, but only a few required termination of adenosine infusion, and almost all (98.3%) evaluated adenosine infusion myocardial SPECT as tolerable.

This is the first report showing the safety of and tolerance to adenosine infusion myocardial SPECT in Japanese patients since it has become available in Japan. Previous reports have shown a considerably high incidence of side-effects in response to adenosine infusion, but these side-effects are mild and usually resolve within 1–2 min after

Table 6 Sequential Changes of ECG Intervals During Stress Test

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>1 min</th>
<th>3 min</th>
<th>6 min</th>
<th>9 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>PQ (s)</td>
<td>0.158±0.028</td>
<td>0.165±0.030*</td>
<td>0.172±0.032*</td>
<td>0.168±0.035*</td>
<td>0.160±0.029</td>
</tr>
<tr>
<td>QRS (s)</td>
<td>0.086±0.017</td>
<td>0.087±0.016</td>
<td>0.087±0.016</td>
<td>0.087±0.016</td>
<td>0.087±0.016</td>
</tr>
<tr>
<td>QTc</td>
<td>0.424±0.033</td>
<td>0.432±0.036*</td>
<td>0.440±0.036*</td>
<td>0.441±0.033*</td>
<td>0.427±0.030</td>
</tr>
</tbody>
</table>

Values are mean±SD.
*p<0.05 (vs pre, Student’s t-test).

Table 7 Post-Test Referral Bias

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before angiography</td>
<td>90.0</td>
<td>58.3</td>
</tr>
<tr>
<td>After angiography</td>
<td>64.3</td>
<td>76.2</td>
</tr>
</tbody>
</table>

Values are %.

Table 8 Sensitivity and Specificity in Individual Coronary Arteries

<table>
<thead>
<tr>
<th>Overall</th>
<th>RCA</th>
<th>LAD</th>
<th>LCx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>75.0</td>
<td>73.7</td>
<td>72.4</td>
</tr>
<tr>
<td>Specificity</td>
<td>69.7</td>
<td>96.2</td>
<td>88.2</td>
</tr>
</tbody>
</table>

Values are %.
RCA, right coronary artery; LAD, left anterior descending coronary artery; LCx, left circumflex coronary artery.

Fig 4. Tolerance scores. After single-photon emission computed tomography (SPECT), patients evaluated their tolerance to adenosine infusion on a scale of 1 to 5, in which 1 was no discomfort and 5 was severe discomfort. Category 1 (no discomfort) comprised 74.6% of patients, and almost all patients (categories 1–3, 98.3%) reported that adenosine infusion myocardial SPECT was relatively tolerable.
termination of adenosine infusion. Previous clinical trials of adenosine infusion SPECT reported in Japan also showed that adenosine is associated with a considerably high incidence of side-effects (66.7–81.0%). Results of a multicenter trial with 9,256 consecutive patients reported that intravenous adenosine infusion caused at least 1 adverse effect in 81% of patients, with more than one-third experiencing chest pain, dyspnea, and/or flushing, and 5% experiencing second- or third-degree AV block; however, all adverse effects appeared within 6 min and almost completely disappeared within 10 min after an adenosine injection. Our results are consistent with those of previous reports and showed that in Japanese patients, side-effects caused by adenosine infusion disappeared quickly despite their high incidence.

Adenosine myocardial perfusion SPECT was well tolerated in our patients. The most severe symptoms experienced (ie, near syncope or sustained 2:1 AV block) were easily controlled by the termination of adenosine infusion. Only a few patients (2 of 206 patients, 0.97%) required additional aminophylline therapy. In terms of sex, the frequency of most side-effects was similar in men and women, with the exception of a higher frequency of chest discomfort in women than in men in the present study. Mohiuddin et al reported that the frequencies of ST-depression and chest pain were significantly greater in women than in men, although the etiologies of these side-effects are unclear. However, there was no significant difference in the tolerance score between men and women in the present study. It should be noted that significantly fewer elderly patients (≥75 years) compared to younger patients (≤64 years) reported some symptoms. A previous report showed that adenosine infusion myocardial SPECT is safe in elderly patients (>80 years). Of course, careful observation of elderly patients is necessary despite the lower frequency of adverse effects and/or symptoms than in younger patients. Therefore, thallium-201 myocardial perfusion SPECT with adenosine is a well-tolerated pharmacologic stress test for the detection of coronary heart disease.

Recently, adenosine triphosphate (ATP) has also been reported as a useful agent for drug-stress myocardial perfusion SPECT. ATP has a very short half-life in plasma, similar to that of adenosine. Adenosine is a degradation product of ATP and can induce maximal coronary vasodilation through the activation of purine receptors. Miyagawa et al reported few side-effects of ATP infusion in comparison with adenosine infusion, and thallium-201 myocardial scintigraphy with intravenous ATP infusion showed a diagnostic value similar to that of intravenous adenosine infusion for detecting coronary artery disease. However, ATP is generally unavailable for myocardial perfusion SPECT in Japan. Further studies are necessary to elucidate the effects of ATP in Japanese populations.

In Japan, thallium-201 myocardial perfusion SPECT has been used widely for the detection of ischemia, and exercise stress perfusion SPECT imaging is used most commonly. Although exercise remains the preferred modality for stress testing, many patients cannot complete maximum stress tests for various reasons. Almost 40% of myocardial perfusion SPECT performed in the USA is performed with pharmacologic stress testing. The number of elderly patients is increasing in Japan, and the inability of patients to complete exercise stress testing will also likely increase. In such cases, thallium-201 myocardial perfusion SPECT in combination with pharmacologic intervention will be useful. The sensitivity and specificity values of adenosine infusion myocardial perfusion SPECT for the detection of ischemic heart disease are similar to those obtained for dipyridamole and exercise stress. Several investigators have reported that the diagnostic accuracy of adenosine thallium-201 perfusion SPECT is comparable to that of exercise or dipyridamole thallium-201 perfusion SPECT. Thus, adenosine infusion myocardial SPECT has considerable sensitivity and specificity, and adenosine should be considered as an appropriate pharmacologic stress reagent for the diagnosis of ischemic heart disease in Japan.

Some limitations of this study should be considered. First, the number of patients enrolled in the present study was relatively low. Studies with higher numbers of patients will be required. Second, we used a 1-route adenosine infusion system and did not compare 1- and 2-route infusion. It should be noted that in this system, when radiotracer was injected as a bolus, the adenosine that was only within the needle was flushed. However, the adenosine contained within the needle had already been diluted with normal saline solution, and the amount was not more than 0.16 ml; thus, the effect of the flushed adenosine might be negligible. Kawai and Kishino also reported that the 1-route infusion protocol is safe and effective (their infusion system was similar, but not identical, to our system).

In conclusion, the results of the present study indicate that thallium-201 myocardial perfusion SPECT with intravenous adenosine infusion is a safe and well-tolerated method for the evaluation of possible coronary artery disease in Japanese patients and is of diagnostic value.

Acknowledgments

The authors wish to thank Mr Naozumi Harada for his help in analyzing the data and for his critical review of this paper. We are also grateful to the radiology technologists, nurses, and medical staff of the Saitomoto Besshi Hospital for their assistance.

References


