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Appropriateness of coronary interventions in Japan by the US and Japanese standards



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Background Appropriateness use criteria (AUC) are widely used to assess quality of care. American professional organizations and Japanese experts have both developed original AUC for percutaneous coronary intervention (PCI). However, rating discrepancies have not been investigated.

Methods Patients registered in the Japanese multicenter PCI registry were analyzed. We assessed the appropriateness of PCI based on both the US and Japanese criteria and compared the ratings. A logistic regression analysis was performed to identify clinical predictors of inappropriate ratings under both standards.

Results From a total of 4,950 nonacute, consecutive PCIs, 1,982 and 2,077 procedures could be successfully rated using the US and Japanese criteria, respectively. The major difference between the 2 criteria was the rating of “asymptomatic, low- or intermediate-risk patients, no lesion in the proximal left anterior descending coronary artery (PLAD)”; this scenario was deemed appropriate in the Japanese but not in the US criteria. As a consequence, the rate of inappropriate PCI using the Japanese criteria (5.2%) was substantially lower when compared with the rating using the US criteria (15%). Common clinical variables associated with “inappropriate” PCI were male, multivessel diseases, and lesions in the non-PLAD. Suboptimal antianginal medication was also a significant predictor of inappropriate PCI under the US but not under the Japanese criteria.

Conclusions Significant and clinically relevant rating discrepancies were observed between the US and Japanese criteria-based assessments, owing largely to the ratings of asymptomatic, non-PLAD-related, low- or intermediate-risk cases. (Am Heart J 2014;168:854-861.e11.)

Percutaneous coronary intervention (PCI) remains the most frequently performed revascularization procedure; in 2012, more than 4,000,000 and 250,000 procedures

were performed in the United States and in Japan, respectively.^{1,2} Currently, most of these procedures are performed to relieve the signs and symptoms of myocardial ischemia, particularly in patients with non-acute disease.³ Given that no survival benefit has been demonstrated and that there may be potential harms from the procedures, the appropriateness of PCI is related to patient selection and is a critical consideration for the patient.

The PCI appropriateness rating, as a supplement to professional guideline documents, is a key tool for driving improvements in health care delivery by supporting the assessment of the judicious use of PCI.^{4,5} Over the past decade, experts in both Japan and the United States have developed appropriateness use criteria (AUC) for PCI. Japanese experts published their AUC in 2007,⁶ and internationally, the AUC for PCI (US-AUC) were published by the American College of Cardiology Foundation and 6 other societies in 2009. These AUCs have been applied to real-world clinical practice, along with various registry data, and have demonstrated that the rates of inappropriate PCI procedures vary markedly across hospitals⁷ and indicate a strong possibility of PCI overuse in real-

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world practice.⁷⁻⁹ However, the differences in the appropriateness ratings for PCI indications, based on both US and Japanese criteria, have not been investigated.

Therefore, our aim was to clarify the discrepancies in the appropriateness ratings of PCI procedures, based on both Japanese and the US standards, and elucidate the common clinical scenarios and variables that led to the differences. A clarification of any rating discrepancies would allow a better understanding of the perceived gap in PCI indications, based on the 2 standards. The results may provide an interpretation of the large proportion of PCIs performed in Eastern countries and may help identify the differences in the use of PCI, which, in turn, may promote awareness of the importance of interpreting clinical studies conducted in each country.

Methods

To examine the differences between the standards and the practical indications for PCIs in the United States and Japan, we retrospectively assessed PCI appropriateness based on both the US-AUC and J-AUC and compared the rate and characteristics of inappropriate PCIs. In this study, we excluded PCIs for acute indications because almost all these procedures were deemed appropriate in a previous study.⁷

Development of the US-AUC

The US-AUC was developed by a collaboration of 6 American professional organizations in 2009. The methodology to develop the AUC for coronary revascularization has been previously described.⁴ We used an algorithm to map PCIs according to the US-AUC and to rate the procedures as appropriate, uncertain, or inappropriate. This algorithm was validated in a previous study⁹ and enabled the mapping to be performed efficiently.

Development of the J-AUC

In Japan, a domestic AUC for coronary revascularization (J-AUC) was developed using the same method as the US-AUC and was published in 2007.⁶ A panel of 9 nationally recognized experts was recruited from across Japan (7 interventional cardiologists and 2 cardiac surgeons). The panelists were required to attend a face-to-face meeting for methodological reasons. They rated the appropriateness of performing PCI in >2,000 clinical scenarios, based on different combinations of (1) clinical presentation; (2) symptom severity (Canadian Cardiovascular Society [CCS] class); (3) presence of ischemia; (4) perioperative risk; (5) diabetic status; (6) left ventricular function; (7) renal function; and (8) extent of anatomic disease, based on angiography. Based on the median score for each clinical indication (range 1-9), clinical indications were categorized as "appropriate" (median 7-9), "uncertain" (4-6), or "inappropriate" (1-3). Agreement among the panelists was defined as an indication where the ratings of ≤ 2 panelists fell outside

the 3-point range containing the median score, and disagreement was defined as a situation where at least 3 panelists' ratings fell in both the appropriate and the inappropriate categories. Any cases that did not fit any of the above situations were defined as indeterminate. We developed an algorithm to map PCIs to the J-AUC and to rate the procedures as appropriate, uncertain, or inappropriate (see online Appendix Supplementary Tables I-XXI and Figures 1-7).

Data source

The Japan Cardiovascular Database (JCD) is an ongoing, prospective, multicenter registry designed to collect clinical background and outcome data on PCI patients.¹⁰ Approximately 200 variables are collected for each patient; clinical variables and in-hospital outcomes for JCD were defined in accordance with the National Cardiovascular Data Registry (NCDR) version 4.1^{11,12} In the JCD-PCI registry, 16 teaching hospitals within the metropolitan Tokyo area participated and registered all PCI procedures performed during the study period, including failed cases, using an Internet-based interface. Clinical research coordinators, specifically trained in registering PCI procedures, confirmed the proper registration of each patient.

Study population

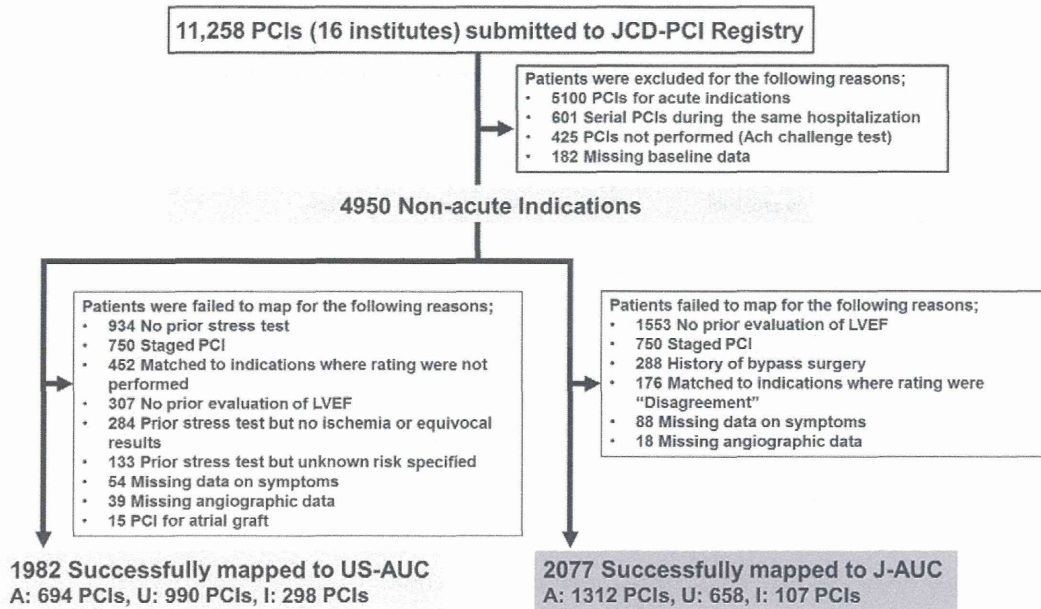
A total of 11,258 patients underwent PCI procedures between September 2008 and March 2013, for acute and nonacute indications, and were registered in the database. A total of 6,308 patients were excluded because their PCIs were for acute indications, they had serial PCIs during the same hospitalization, there were insufficient baseline data, or they only underwent the acetylcholine challenge test; the remaining 4,950 patients were included in our study (Figure 1). The proportion of PCIs classified as appropriate, uncertain, or inappropriate was determined based on both the US-AUC and the J-AUC. Then, we compared the rate and characteristics of inappropriate PCIs, and the common scenarios with rating discrepancies were identified and listed.

Two separate multivariate logistic regression analyses were used to identify the independent variables associated with the performance of inappropriate PCIs, based on the 2 AUC standards. All baseline variables related to inappropriate PCIs in the univariate analysis (defined as $P < .10$) were further analyzed using a stepwise, multivariate model. Analyses of data were performed using SPSS, version 21 (SPSS, Chicago, IL). All P values were 2 sided, and significance was defined as $P < .05$.

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Figure 1



Study cohort creation. Abbreviations: Ach, acetylcholine; LVEF, left ventricle ejection fraction; A, appropriate; U, uncertain; I, inappropriate.

analyses, the drafting and editing of the manuscript, and the final contents of the manuscript.

Results

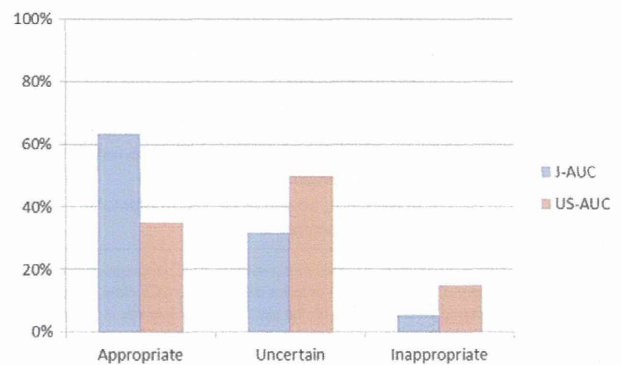
Patient characteristics

The clinical characteristics of patients who underwent elective PCIs were summarized in an online Appendix Supplementary Table XXII. The mean age was 68.2 ± 9.7 years; 80.9% were male. The prevalence of a prior history of coronary artery bypass grafting (CABG) was lower than previously reported.⁷ Furthermore, revascularization was widely performed for asymptomatic patients, and the rate of prescriptions for antianginal medications, especially β -blockers, was lower. The baseline differences between the patients rated under the US-AUC and those rated under the J-AUC are summarized in an online Appendix Supplementary Table XXIII. Although several differences were observed regarding the previous history of revascularization, anatomical features, or symptomatic status, the baseline characteristics of the patients rated under the US-AUC and those rated under the J-AUC were almost similar.

Ratings under the US-AUC

Of the 4,950 procedures, ratings could not be determined for 2,968 PCIs, leaving a total of 1,982 PCIs that were rated (Figure 1) using the US-AUC. Among the 1,982 patients, 35.1% of the PCIs were classified as appropriate; 49.9%, as uncertain; and 15.0%, as inappropriate (Figure 2). Overall, almost all of the inappropriate

Figure 2



Percutaneous coronary intervention appropriateness in nonacute settings according to each criterion.

PCIs were confined to 5 scenarios, as summarized in Table I. Frequently encountered scenarios included PCIs with suboptimal antianginal medications or involvement of single or multiple epicardial vessels other than the left main trunk (LMT) or the proximal left anterior descending artery (PLAD).

Ratings under the J-AUC

Among 4,950 consecutive PCI procedures, patients with prior histories of CABG were excluded, due to the lack of ratings for such a situation in the J-AUC. The remaining 2,077 procedures were successfully mapped

Table I. Most frequent clinical scenarios for PCIs classified as inappropriate by US-AUC

US-AUC scenario no.	Anatomy	Indication				n (%)
		Prior CABG	Symptoms	Cardiac risk (noninvasive tests)	Antianginal medication	
Inappropriate PCIs						
14a	1- or 2-vessel CAD, no proximal LAD involvement	No	Asymptomatic	Intermediate	None or minimal	298 146 (49.0)
12a	1- or 2-vessel CAD, no proximal LAD involvement	No	Asymptomatic	Low	None or minimal	60 (20.1)
12b	1- or 2-vessel CAD, no proximal LAD involvement	No	CCS class I or II	Low	None or minimal	57 (19.1)
56a	≥1 stenoses in non-CABG territory all bypass grafts patent	Yes	Asymptomatic	Intermediate	None or minimal	13 (4.4)
24a	CTO of 1 major coronary artery without other coronary stenoses	No	Asymptomatic	Intermediate	None or minimal	12 (4.0)

Abbreviations: PCI, percutaneous coronary intervention; AUC, appropriate use criteria; CAD, coronary artery disease; LAD, left anterior descending; CCS class, Canadian Cardiovascular Society angina class; CABG, coronary artery bypass grafting; CTO, chronic total occlusion. All values are expressed as a number with the percentage of subjects in parentheses.

Table II. Most frequent clinical scenarios for PCIs classified as inappropriate by J-AUC

J-AUC scenario no.	Anatomy	Symptoms	Indication			Cardiac risk (noninvasive tests)	Perioperative risk (Euroscore >5%)	n (%)
			LVEF	DM	CKD			
Inappropriate PCIs								
15	2-vessel CAD, no proximal LAD involvement	Asymptomatic	>35%	Yes	No	Negative or not performed	No	107 54 (50.5)
15	1-vessel CAD, no proximal LAD involvement	Asymptomatic	>35%	N/A	Yes	Negative or not performed	No	6 (5.6)
3	Left main trunk, bifurcation	CCS class I or II	>35%	Yes	No	Negative or not performed	No	5 (4.7)
2	Left main trunk, bifurcation	Asymptomatic	>35%	No	No	Negative or not performed	No	4 (3.7)
15	2-vessel CAD, no proximal LAD involvement	Asymptomatic	>35%	No	Yes	Negative or not performed	No	4 (4.2)
15	1-vessel CAD, no proximal LAD involvement	Asymptomatic	≤35%	N/A	Yes	Negative or not performed	Yes	4 (4.2)

Abbreviations: PCI, percutaneous coronary intervention; AUC, appropriate use criteria; LVEF, left ventricular ejection fraction; DM, diabetes mellitus; CKD, chronic kidney disease; CAD, coronary artery disease; LAD, left anterior descending; CCS class, Canadian Cardiovascular Society angina class. All values are expressed as a number with the percentage of subjects in parentheses.

to ratings included in the J-AUC. Of these 2,077 procedures, 63.2% of PCIs were classified as appropriate; 31.7%, as uncertain; and 5.2%, as inappropriate (Figure 2). Frequently encountered inappropriate PCIs under the J-AUC are outlined in Table II. Almost all the inappropriate PCIs were confined to a single scenario: PCI for 1- or 2-vessel coronary artery disease (CAD) without PLAD involvement, without any symptoms, and negative or no results from noninvasive tests.

Discrepancy between the US and Japanese criteria

Among the patients who underwent PCI in the nonacute settings, 1,181 patients could be rated by both the US-AUC and the J-AUC. There were 183 patients who were rated as appropriate by the J-AUC, but

inappropriate by the US-AUC. In the J-AUC, patients with 1- or 2-vessel CAD and no PLAD involvement were categorized as “appropriate,” regardless of whether they were symptomatic, if they had established signs of ischemia from noninvasive testing; this scenario was the main reason for the discrepancy. Other frequent scenarios for the discrepancy in this rating are listed in Table III and included the lack of use of antianginal medications despite demonstrated ischemia in noninvasive testing.

Clinical variables associated with performing inappropriate PCIs

Multivariable modeling revealed 3 common clinical variables associated with inappropriate PCIs under both sets of standards: male, multivessel disease, and non-

Table III. Most frequent clinical scenarios with an absolute discrepancy

US-AUC scenario no.	Indication				n* (%)
	Anatomy	Symptoms	Cardiac risk (noninvasive tests)	Anginal medication	
Appropriate in J-AUC, but inappropriate in US-AUC					183
14a	1- or 2-vessel CAD, no proximal LAD involvement	Asymptomatic	Intermediate	None or minimal	90 (49.2)
12a	1- or 2-vessel CAD, no proximal LAD involvement	Asymptomatic	Low	None or minimal	40 (21.9)
12b	1- or 2-vessel CAD, no proximal LAD involvement	CCS class I or II	Low	None or minimal	40 (21.9)
24a	CTO of 1 major coronary artery without other coronary stenoses	Asymptomatic	Intermediate	None or minimal	8 (4.4)

Abbreviations: US-AUC, United States appropriateness use criteria; J-AUC, Japanese appropriateness use criteria; CAD, coronary artery disease; LAD, left anterior descending; CCS class, Canadian Cardiovascular Society angina class; CTO, chronic total occlusion.

* All values are expressed as a number with the percentage of subjects in parentheses.

Table IV. Independent variables associated with performing inappropriate PCIs based on each criterion

	US-AUC		J-AUC	
	Odds ratio (95% CI)	P	Odds ratio (95% CI)	P
Female	0.62 (0.44-0.88)	.008	0.39 (0.19-0.79)	.009
Previous MI	2.09 (1.58-2.77)	<.001		
DM			8.85 (4.80-16.3)	<.001
No. of diseased vessels				
1-vessel disease	Reference		Reference	
2-vessel disease	13.6 (6.73-27.3)	<.001	3.76 (1.40-10.1)	.008
3-vessel disease	14.0 (6.97-28.1)	<.001	18.4 (7.08-48.0)	<.001
LMT	0.05 (0.01-0.34)	.003	44.9 (17.7-114)	<.001
Proximal LAD	0.02 (0.01-0.09)	<.001	0.18 (0.09-0.38)	<.001
Optimal antianginal medication	0.08 (0.02-0.34)	.001		
LVEF <35%			4.15 (1.79-9.57)	.001
Creatinine >2 mg/dL			14.5 (7.83-26.8)	<.001

Abbreviations: PCI, percutaneous coronary intervention; US-AUC, United States appropriateness use criteria; J-AUC, Japanese appropriateness use criteria; MI, myocardial infarction; LMT, left main trunk; LAD, left anterior descending artery; LVEF, left ventricular ejection fraction.

PLAD lesions. Previous myocardial infarction and suboptimal antianginal medications were also significant predictors of inappropriate PCI under the US-AUC, but not under the Japanese standards; diabetes mellitus-reduced left ventricular function and renal dysfunction were predictors under the Japanese, but not the US standards (Table IV). On the other hand, PCI for LMT was associated with inappropriate PCIs, based on the J-AUC.

Discussion

In this contemporary, multicenter, Japanese PCI registry, approximately one-sixth of the nonacute PCIs were rated as inappropriate under the US standard (US-AUC), but this percentage substantially decreased when assessed against the Japanese criteria (J-AUC). This rating discrepancy

was mainly due to a gap in the perception regarding the need for revascularization for low- or intermediate-risk patients without PLAD lesions and demonstrated the need for further study of this population.

The US- and J-AUC were developed using the same method and close to the same time but emphasized very different clinical characteristics. Preprocedurally, under the US-AUC, evaluation of the extent of ischemia and the use of optimal medical therapy are key considerations for determining the appropriateness of PCI. On the other hand, the J-AUC put more emphasis on age, left ventricular ejection fraction, renal function, and the presence of diabetes mellitus but did not emphasize evaluation of the extent of ischemia or the implementation of optimal medical therapy (see online Appendix Supplementary Tables I-XXI and Figures 1-7). These

differences between the US and Japanese criteria were reflected in the disparity of the independent predictors for inappropriate PCIs, yielding significant and clinically important rating discrepancies.

Naturally, the main rating discrepancies between the US-AUC and J-AUC were explained by the revascularization of asymptomatic, low- or intermediate-risk patients without PLAD involvement. Professional guideline recommendations differ between the United States and Japan, particularly those related to stable ischemic heart disease. Both PCI plus medical therapy and initial medical therapy are recommended in the Japanese guideline,¹³ but the current American College of Cardiology/American Heart Association guideline does not recommend performing PCI for this population.¹⁴ The statement in the Japanese guideline is based mainly on the results of the Japanese Stable Angina Pectoris study, which evaluated the effectiveness of PCI for such stable low-risk CAD patients compared with medical therapy, in a randomized setting, and demonstrated the long-term benefit of PCI.¹⁵ However, this was a single, small, randomized controlled trial with insufficient optimal medical therapy and included the application of revascularization procedures as an end point. Clearly, further studies involving the Japanese population are needed to close the perception gap for PCI indications that lack sufficient scientific underpinning. Of note, the number of PCI procedures in Japan is also disproportionately large compared with CABG, with PCI estimated to be >14 times as common as CABG,² and the interventionists' predilection toward these rather "minor" vessel diseases may have led to this discrepancy.

The gap between the US and Japanese guidelines of CAD is well reflected in the differences between the US-AUC- and J-AUC-based ratings. In the US guideline, with regard to the recommended indication of revascularization aimed at improving survival for asymptomatic patients, most PCIs for 1- or 2-vessel CAD not involving PLAD are categorized as class III recommendations.¹⁴ Similarly, in the European guideline, PCIs for asymptomatic patients with coronary lesions other than LMT or PLAD or vessel subtending area of ischemia <10% of the myocardium are classified as class III recommendation.¹⁶ As with these guideline recommendations, almost all PCIs for 1- or 2-vessel CAD without PLAD are rated as inappropriate, except for cases with severe ischemia, in the US-AUC.⁴ On the other hand, the Japanese guideline accepts the indications of PCIs even for asymptomatic patients, as long as the stress test demonstrates positive results, regardless of the extent of the ischemic area.¹³ This permissive recommendation of the Japanese guideline for asymptomatic patients is consistent with the ratings assessed using the J-AUC.⁵

The trend to favor PCIs over CABG in Japan was recognized even in the revascularization for high-risk

patients. The results of the comparison of the appropriate ratings for multivessel disease between the J-AUC and US-AUC are summarized in an online [Appendix Supplementary Table XXV](#). Although almost all the PCIs for multivessel disease, including both 2- and 3-vessel diseases, with the exception of PCIs for 3-vessel disease with chronic kidney disease and low operative risk, were categorized as appropriate under the J-AUC, appropriate indication was confined to 2-vessel disease under the US-AUC. Meanwhile, although all the CABG procedures for multivessel disease were classified as appropriate based on the US-AUC, the indication of CABG for multivessel disease with high operative risk was not rated as appropriate based on the J-AUC. This discrepancy in revascularization strategy for high-risk patients would also be a reason for the disproportionately large ratio of PCI cases compared with CABG cases in Japan.

When the specific clinical variables that were associated with the inappropriate ratings were investigated, the suboptimal use of antianginal medications was an independent predictor of inappropriate PCI under the US-AUC, but not under the J-AUC. Today, stable CAD can be frequently managed by medical therapy alone.³ The discrepancy for the appropriateness ratings of PCI procedures under Japanese and American standards allows a better understanding of the perception gap for PCI indications between the 2 countries. On the other hand, the J-AUC adopted a negative attitude toward revascularization for LMT disease. The main reason for this perception difference was that LMT lesions were categorized into 2 types according to the location of the lesion; ostial/shaft and bifurcation were recognized as the same "LMT" lesion in the US-AUC. In the J-AUC, the ostial/shaft lesions were likely to be rated as appropriate, whereas the bifurcated LMT lesions tended to be categorized as inappropriate.

Thus, perception gaps exist regarding the revascularization strategies in Japan and the United States, and these gaps are reflected in the differences in clinical practice between the countries; we have to be careful when interpreting clinical studies conducted in each country. Actually, an assessment of ischemic risk from the stress study indicated high risk in 30.4% of PCI patients in the United States,¹ whereas only 16.5% of patients who underwent PCI demonstrated high risk in the Japanese registry. Although the proportion of elective PCIs accounts for <40% of all PCIs in the United States, approximately 75% of PCIs are performed for nonacute indications in Japan.^{1,2} Furthermore, revascularizations have been widely performed for asymptomatic patients who were identified through the unique regular health checkups, including screening electrocardiogram.¹⁷ These differences suggest that, in Japan, compared with the United States, PCI is performed in patients with lower cardiovascular risk.

Limitations

For a thorough understanding of our results, several limitations should be acknowledged. First, in our study, almost half of the patients could not be rated using both the US-AUC and J-AUC. The main reason of the mapping failure in the US-AUC was the lack of prior stress tests. Of course, revascularization for patients who do not show signs of ischemia is unacceptable; this is a fundamental principle in the American College of Cardiology/American Heart Association guideline.¹⁴ However, technological evolution of cardiovascular imaging has occurred recently, and the number of coronary computed tomography angiography (CCTA) is increasing remarkably in Japan, whereas stress testing remains the main modality in the United States. Because CCTA only provides anatomical information, this modality is not recognized as a prior noninvasive test under the current criteria despite the excellent negative and acceptable positive predictive values.¹⁸ This difference in preprocedural evaluation for coronary artery disease might have contributed to the higher rate of unsuccessful mapping in our study. In fact, approximately one-third of the patients in our registry who did not undergo noninvasive stress testing underwent CCTA. Meanwhile, the most common reason for mapping failure under the J-AUC was the absence of prior evaluation of left ventricular systolic function ($n = 1553$, 31.4%). The Japanese criteria require information regarding left ventricular systolic function in almost all cases, which are needed in limited scenarios under the US-AUC, such as left main or triple-vessel disease. From this view, the J-AUC leaves room for improvement in the rate of successful mapping. Previous studies reported similar rates of mapping failure (38.6%–50%),^{7,9} which indicate that the current criteria still have room for improvement to permit a more precise evaluation of appropriateness.

Second, several issues have emerged concerning the establishment of the J-AUC. The J-AUC reflects the standards of the interventional and surgical experts who are practicing in Japan and have knowledge of both international guidelines and the unique characteristics of Japanese patients. However, the J-AUC was established in 2007, before the publication of the COURAGE trial.³ Although several studies demonstrated the importance of optimal medical therapy compared with revascularization,^{19,20} it was not yet highlighted at that time. Therefore, albeit the adequate allowance of J-AUC-based assessment, application of more-updated AUC is required to detect potential targets for quality improvement in the use of PCI.

Furthermore, the composition of the J-AUC panel was weighted more toward interventionists. For the last 2 decades, Japanese cardiovascular medicine has focused mainly on the interventional field, and general cardiology has been considered less important. For that reason, most of the established members in the cardiovascular

society were interventionists at the time of establishment of the J-AUC, and the panel members of the J-AUC composed chiefly of interventional cardiologists, despite the traditional RAND methodology being used. This skewed composition of panel members might have influenced the ratings because interventionists are more likely to classify procedures as appropriate compared with noninterventionists.²¹ However, to minimize potential bias, a general cardiologist with cardiovascular training from the United States (S.K.) and an epidemiologist (T.H.) prepared the discussion materials. They were also actively involved in the case discussions regarding interpretation of the available evidence, and we believe that this process aided in minimizing the bias.

Finally, an accurate comparison could not be made because the parameters used to evaluate procedural appropriateness differ between the Japanese and US AUC. More detailed parameters, including perioperative risk, diabetic status, and renal function, were evaluated in the J-AUC and may serve as a useful reference for improving the US-AUC.

Conclusions

In a Japanese multicenter PCI registry, approximately one-sixth of all PCIs were rated as inappropriate under the US-AUC in nonacute settings; however, the rate of inappropriate PCIs was substantially lower when rated by the Japanese standard (J-AUC). This discrepancy is believed to be due to differences in the appropriateness ratings for revascularization of asymptomatic, low- or intermediate-risk patients without PLAD involvement. Moreover, this discrepancy may be a result of cultural differences and the unique health care system in Japan.

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Appendix

Supplementary Table I

	Logistic Euroscore <5%		Logistic Euroscore ≥5%	
	CKD(-)	CKD(+)	CKD(-)	CKD(+)
	Age <75 y			
LMT (bifurcation)				
DM(-)				
LVEF >35%	U(4)	I(3)	U(6)	U(4)
LVEF ≤35%	I(3)	I(2)	U(6)	U(4)
DM(+)				
LVEF >35%	I(2)	I(2)	U(6)	U(4)
LVEF ≤35%	I(2)	I(2)	U(6)	U(4)
LMT (ostium or body)				
DM(-)				
LVEF >35%	D	D	A(8)	A(7)
LVEF ≤35%	D	U(5)	A(8)	A(7)
DM(+)				
LVEF >35%	D	D	A(8)	A(7)
LVEF ≤35%	D	U(5)	A(8)	A(7)
Age ≥75 y				
LMT (bifurcation)				
DM(-)				
LVEF >35%	U(4)	I(3)	A(7)	U(6)
LVEF ≤35%	I(3)	I(2)	U(6)	U(5)
DM(+)				
LVEF >35%	I(3)	I(2)		U(5)
LVEF ≤35%	I(3)	I(2)	U(6)	U(5)
LMT (ostium or body)				
DM(-)				
LVEF >35%	A(7)	U(6)	A(8)	A(7)
LVEF ≤35%	U(6)	U(5)	A(8)	A(7)
DM(+)				
LVEF >35%	A(7)	U(6)	A(8)	A(7)
LVEF ≤35%	U(6)	U(5)	A(8)	A(7)

Supplementary Table II

	Logistic Euroscore <5%		Logistic Euroscore ≥5%	
	CKD(-)	CKD(+)	CKD(-)	CKD(+)
	Age <75 y			
LMT (bifurcation)				
DM(-)				
LVEF >35%	I(2)	I(2)	U(5)	U(4)
LVEF ≤35%	I(3)	I(2)	U(5)	U(4)
DM(+)				
LVEF >35%	I(2)	I(2)	U(5)	U(4)
LVEF ≤35%	I(3)	I(2)	U(4)	U(4)
LMT (ostium or body)				
DM(-)				
LVEF >35%	I(2)	I(2)	U(5)	U(5)
LVEF ≤35%	U(5)	U(4)	U(5)	U(4)
DM(+)				
LVEF >35%	I(2)	I(2)	U(5)	U(4)
LVEF ≤35%	U(4)	I(3)	U(5)	U(4)
Age ≥75 y				
LMT (bifurcation)				
DM(-)				
LVEF >35%	I(3)	I(2)	U(5)	U(4)
LVEF ≤35%	I(3)	I(2)	U(5)	U(4)
DM(+)				
LVEF >35%	I(3)	I(2)	U(5)	U(4)
LVEF ≤35%	I(3)	I(2)	U(4)	U(4)
LMT (ostium or body)				
DM(-)				
LVEF >35%	U(5)	U(4)	U(5)	U(5)
LVEF ≤35%	U(5)	U(4)	U(5)	U(4)
DM(+)				
LVEF >35%	U(5)	U(4)	U(5)	U(4)
LVEF ≤35%	U(4)	I(3)	U(5)	U(4)

Abbreviations: CKD, Chronic kidney disease; DM, diabetes mellitus; LVEF, left ventricular ejection fraction; A, appropriate; U, uncertain; I, inappropriate.