

Poor Implementation of Cardiac Rehabilitation Despite Broad Dissemination of Coronary Interventions for Acute Myocardial Infarction in Japan

— A Nationwide Survey —

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Background The implementation of cardiac rehabilitation (CR) after acute myocardial infarction (AMI) has not been fully investigated in Japan, so a nationwide survey of hospitals was conducted.

Methods and Results Questionnaires were sent in 2004 to a total of 1,875 hospitals in Japan, including all the 859 Japanese Circulation Society (JCS)-authorized cardiology-training hospitals (THs), 311 JCS-associated hospitals (AH), and 705 randomly sampled non-THs (NTHs). The response rate was 59% (1,106/1,875). The percentages of hospitals treating hospitalized AMI patients were 97% in 526 TH, 85% in 194 AH, and 20% in 339 NTH. Although the rates of implementation of emergency percutaneous coronary intervention were very high (92%, 56%, and 4%, respectively), the rates of implementation of recovery phase CR were low (20%, 8%, and 2%, respectively). In addition, patient education programs (23%, 13% and 2%) and formulated exercise prescriptions based on exercise testing (16%, 7% and 1%) were poorly implemented. More importantly, only 9%, 2% and 0% of these hospitals had outpatient CR programs. From these data, the nationwide participation rate in outpatient CR after AMI in Japan was estimated to be only 3.8–7.6%.

Conclusion This first nationwide survey demonstrated that, in contrast to the broad dissemination of acute phase invasive treatment for AMI, the implementation of recovery phase CR, especially outpatient CR, is extremely poor in Japan. In addition, patient education programs and exercise prescription based on exercise testing are only poorly implemented. (*Circ J* 2007; 71: 173–179)

Key Words: Acute myocardial infarction; Cardiac rehabilitation; Exercise prescription; Percutaneous coronary intervention

There is ample evidence showing that cardiac rehabilitation (CR) with exercise training improves functional capacity and quality of life^{1–5} and reduces cardiovascular and total mortality^{1,6,7} in patients with acute myocardial infarction (AMI). However, the implementation of CR in Japan has been limited to large hospitals, and thought to be insufficient nationwide.⁸ The fee for CR after AMI is reimbursed by the Japanese health insurance system only to hospitals approved for CR which fulfill the CR facility standards. According to the Japanese Association of Cardiac Rehabilitation, the number of hospitals approved for CR was only 164 in August 2004⁹ and 186 in February 2005, which is in sharp contrast to the number of hospitals performing percutaneous coronary intervention (PCI) for coronary artery disease (>1,000 hospitals).^{10,11}

A recent study demonstrated that the participation rate in CR programs by hospitalized patients with AMI in 1996–

1998 was 34% in CR-approved hospitals and 8% in non-approved hospitals in Japan, and they estimated the nationwide participation rate to be 5–12%.¹² However, that was a small survey of 46 hospitals with cardiology divisions, and there has not been a nationwide large-scale survey of CR in Japan.

Recently, the length of hospital stay for patients with AMI has been substantially shortened, because emergency PCI enables early ambulation and the economic pressure to minimize hospital stay has increased. This shortening of hospitalization has made it difficult for the “traditional in-hospital CR” program with exercise training and patient education to be performed in time, but outpatient CR programs, which should be an alternative for traditional in-hospital CR programs, do not appear to be widely used and the actual implementation of outpatient CR programs in Japan has not been investigated.

Accordingly, the purpose of the present study was to investigate the status of CR for patients with AMI in Japan by conducting a nationwide large-scale survey, with special reference to comparisons of implementation of acute-phase invasive treatment, such as emergency PCI, and recovery-phase CR for AMI.

(Received July 27, 2006; revised manuscript received October 24, 2006; accepted November 6, 2006)

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Table 1 Hospital Size and Cardiac Care According to Hospital Category

	JCS training hospital	JCS associated hospital	Non-training hospital	Total
No. of surveyed hospitals	526 (100%)	194 (100%)	339 (100%)	1,059 (100%)
<i>Hospital data</i>				
No. of hospital beds	467±258	262±133	138±114	324±249
No. of cardiology beds	40±19	25±19	2.4±7.8	27±23
No. of cardiologists (full time + part-time)	8.2±9.4	3.5±2.8	1.0±2.6	5.0±7.6
Coronary care unit	360 (68.4%)	62 (32.0%)	6 (1.8%)	423 (39.9%)
Cardiac surgery section	300 (57.0%)*	23 (11.9%)*	3 (0.9%)	326 (30.8%)
Approved for specific intensive care	240 (45.6%)*	26 (13.4%)*	8 (2.4%)	274 (25.9%)
Approved for CR	65 (12.4%)*	3 (1.5%)*	1 (0.3%)	69 (6.5%)
<i>Status of cardiology care</i>				
Hospitals treating AMI	511 (97.1%)	163 (84.0%)	68 (20.1%)	742 (70.1%)
No. of patients with AMI (per year)	59.5±49.6	19.1±22.6	2.0±6.9	33.7±44.9
Hospitals implementing coronary arteriography	503 (95.6%)	135 (69.6%)	16 (4.7%)	654 (61.8%)
No. of coronary arteriography (procedures/year)	626±709	160±208	11±71	344±583
Hospitals implementing PCI	495 (94.1%)	115 (59.3%)	13 (3.8%)	623 (58.8%)
No. of PCI (procedures/year)	191±223	42±67	3±19	104±183
Hospitals implementing emergency PCI	486 (92.4%)	109 (56.2%)	12 (3.5%)	607 (57.3%)
No. of emergency PCI (procedures/year)	58±56	15±31	1±6	32±49

JCS, Japanese Circulation Society; CR, cardiac rehabilitation; AMI, acute myocardial infarction; PCI, percutaneous coronary intervention.

* $p < 0.01$ compared with the implementation rate of emergency PCI in each hospital category.

Methods

This study was conducted by the research group of the "Study on the current status and promotion of cardiac rehabilitation in Japan (Japanese Cardiac Rehabilitation Survey)". There were 8,245 hospitals practicing cardiology or internal medicine in Japan in 2002,¹³ and of those, 859 with a cardiology section were authorized by the Japanese Circulation Society (JCS) as "Training hospitals for the Board-Certified Member of the JCS" (THs) and 311 were designated as "Associated hospitals" (AHs) at the time of this survey (ie, in 2004). Of the remaining 7,075 hospitals not designated as TH or AH, 10% were randomly sampled, 2 of which had been closed, and therefore 705 hospitals were identified as random-sampled non-THs (NTHs). Questionnaires were sent in February to May, 2004, to a total of 1,875 hospitals including all of the 859 THs and 311 AHs, and random-sampled 705 NTHs. The response rate was 59% (1,106/1,875), with THs 63% (541/859), AHs 66% (204/311) and NTHs 51% (361/705).

The questionnaire surveyed the following: (1) hospital data: number of beds, number of cardiologists, approval as a specific intensive care facility by the specific intensive care unit (ICU) standards, and approval as a CR facility; (2) cardiology practice data in 2003: number of hospitalized patients with AMI, implementation of coronary arteriography, implementation of PCI, and implementation of emergency PCI; (3) implementation of CR: acute phase CR for patients with AMI, recovery phase CR, patient education programs, formulated exercise prescriptions based on exercise testing, cardiopulmonary exercise testing with respiratory gas analysis, and outpatient CR program after hospital discharge. The data sheets were collected and analyzed at the Division of Cardiology, National Cardiovascular Center.

The CR facility standards for CR fee reimbursement at the time of this survey were: (1) attendance of a staff physician with access to facilities of an authorized ICU in case of emergency, (2) an exclusive CR training room equipped with appropriate devices, and (3) at least one full-time CR physician and 1 nurse or physical therapist.

Statistical Analysis

Data were analyzed according to the hospital categories. Numerical data are presented as means ± standard deviation. Chi-square test was used to compare the rate of implementation of emergency PCI (a representative therapeutic procedure for AMI) and that of various types of CR activities in each hospital category. Next, Bonferroni's corrections were used to compensate the compromised statistical certainty by the multiple comparisons. Thus, p -values smaller than the usual cutoff levels divided by the number of comparisons (ie, $0.05/10=0.005$ and $0.01/10=0.001$) were considered to be statistically significant at the risk levels of 5% and 1%, respectively.

Ethical Considerations

This study did not deal with data from individual patients, and conformed to the 2004 revised version of the Ethical Guidelines of Epidemiological Study by the Ministry of Education, Culture, Sports, Science and Technology and the Ministry of Health, Labor and Welfare of Japan.

Results

Effective replies were obtained from 1,059 hospitals including 526 THs (61% of all THs in Japan), 194 AHs (62% of all AHs), and 339 NTHs (4.8% of all NTHs).

Hospital Data

The hospital data are summarized in Table 1 and indicate that the THs are large, general hospitals equipped with sufficient numbers of total hospital beds (467±258 beds), cardiology beds (40±19 beds), and staff cardiologists (8.2±9.4 including both full-time and part-time staff). Although 32% of THs did not have an independent coronary care unit (CCU), most had an ICU available as a CCU for AMI patients. Approximately half of the THs had a cardiac surgery section and had been approved as a "specific intensive care" facility (ie, equipped with an authorized high-quality ICU). However, only 12% (65/526) of all THs, or only 27% (65/240) of the hospitals approved for specific intensive care, had been approved as a CR facility, which implied that the

Table 2 Use of CR for Patients With AMI According to Hospital Category

	JCS training hospital (n=526)	JCS associated hospital (n=194)	Non-training hospital (n=339)	Total (n=1,059)
<i>Implementation of CR for AMI</i>				
Any CR for AMI	281 (53.4%)*	66 (34.0%)*	16 (4.7%)	363 (34.4%)
Acute-phase CR for AMI	256 (48.7%)*	59 (30.4%)*	10 (2.9%)	325 (30.7%)
Recovery-phase CR for AMI	104 (19.8%)*	16 (8.2%)*	5 (1.5%)	125 (11.8%)
Outpatient CR program after discharge	49 (9.3%)*	3 (1.5%)*	0 (0%)*	52 (4.9%)
Patient education program	123 (23.4%)*	26 (13.4%)*	5 (1.5%)	154 (14.5%)
Exercise prescription based on exercise test	86 (16.3%)*	13 (6.7%)*	3 (0.9%)	102 (9.6%)
Cardiopulmonary exercise test with expired gas analysis	72 (13.7%)*	5 (2.6%)*	0 (0%)*	77 (7.3%)
<i>Number of AMI patients who participated in CR in each hospital</i>				
Patients who participated in any CR (patients/year)	13.0±31.0	4.1±16.6	0.36±3.0	7.2±23.5
Patients who participated in recovery-phase CR (patients/year)	9.2±28.6	1.5±14.6	0.2±2.3	4.9±21.5
Patients who participated in outpatient-CR assuming 100% transfer from recovery-phase CR (patients/year)	5.7±23.4	0.08±0.8	0.0±0.0	2.8±16.7
Patients who participated in outpatient-CR assuming 50% transfer from recovery-phase CR (patients/year)	2.8±11.7	0.04±0.4	0.0±0.0	1.4±8.4
<i>Pooled data in each category</i>				
Patients with AMI (patients/year)	31,366	3,704	669	35,739
Patients who participated in any CR (patients/year)	6,711	793	121	7,624
Patients who participated in recovery-phase CR (patients/year)	4,847	295	69	5,212
Patients who participated in outpatient-CR assuming 100% transfer from recovery-phase CR (patients/year)	2,981	15	0	2,996
Patients who participated in outpatient-CR assuming 50% transfer from recovery-phase CR (patients/year)	1,491	8	0	1,498
<i>Estimated participation rate in CR in each category[#]</i>				
Participation rate in any CR (% of AMI survivors)	23.8	23.8	20.1	23.7
Participation rate in recovery-phase CR (% of AMI survivors)	17.2	8.9	11.5	16.2
Participation rate in outpatient-CR assuming 100% transfer from recovery-phase CR (% of AMI survivors)	10.6	0.4	0	9.3
Participation rate in outpatient-CR assuming 50% transfer from recovery-phase CR (% of AMI survivors)	5.3	0.2	0	4.2

Abbreviations see in Table 1.

* $p < 0.01$ compared with the implementation rate of emergency PCI in each hospital category.

[#]Estimated participation rate was calculated as the number of participants relative to the number of acute-phase survivors. Acute-phase survival rate was assumed to be 90% according to previous reports (references 15 and 16).

remaining 73% (175/240) of the hospitals approved for specific intensive care did not have approval as a CR facility despite their potential ability to fulfill the CR facility standards, because the presence of an authorized ICU was 1 of the major components of the CR facility standards.

According to the hospital data, AHs are considered to be medium-sized hospitals with 262±133 total hospital beds and 25±19 cardiology beds. Of those, 32% had a CCU and 13% had been approved for specific intensive care. However, again, only 1.5% (3/194) of AHs were approved hospitals for CR.

Random-sampled NTHs are considered to be small-sized hospitals with 138±114 total beds and only a few cardiology beds. Only 1–2% of NTHs are equipped with a CCU and cardiac surgery section, and had been approved for specific intensive care. As anticipated, only 1 hospital (0.3%) had been approved for CR.

Status of Cardiology Care

Of the 526 THs, almost all (97%) were treating hospitalized AMI patients and the rates of implementation of invasive cardiac procedures, such as coronary arteriography, PCI, and emergency PCI, were all higher than 90% (Table 1). Of the 194 AHs, 84% were treating hospitalized AMI patients, 70% were performing coronary arteriography, and more than half were performing PCI and emergency PCI. Of the 339 NTHs, 20% were treating AMI patients, but only a few were performing invasive cardiac

procedures. As a whole, 70% of 1,059 hospitals were treating AMI patients, and more than half were performing coronary arteriography, PCI, and emergency PCI.

The number of hospitalized AMI patients in each hospital in the year of 2003 averaged 59.5±49.6 patients/year in THs, 19.1±22.6 patients/year in AHs, and 2.0±6.9 patients/year in NTHs, and the total number of AMI patients hospitalized in the 1,059 hospitals in this survey amounted to 35,665 patients/year. These data estimated that in the year of 2003, 51,111 (59.5×859=51,111), 5,940 (19.1×311=5,940), and 14,150 (2.0×7075=14,150) AMI patients were hospitalized in all THs, AHs, and NTHs, respectively, yielding an estimated total number of hospitalized AMI patients in all over Japan to be 71,201 patients/year. This figure closely agreed with the number of hospitalized AMI patients of 66,459 patients in the year of 2000 in a previous nationwide survey.¹⁴ In addition, this estimation indicated that approximately 72% (51,111/71,201) of all hospitalized AMI patients in Japan were treated in THs, and 80% (57,051/71,201) were treated in either THs or AHs.

Implementation of CR for AMI

Implementation of CR for AMI and the numbers of patients who participated in CR are summarized in Table 2. The rates of implementation of any CR and acute-phase CR for AMI patients were approximately 50% for THs, 30% for AHs, and less than 5% for NTHs, which were lower than the rates of invasive procedures for AMI in these hospitals.

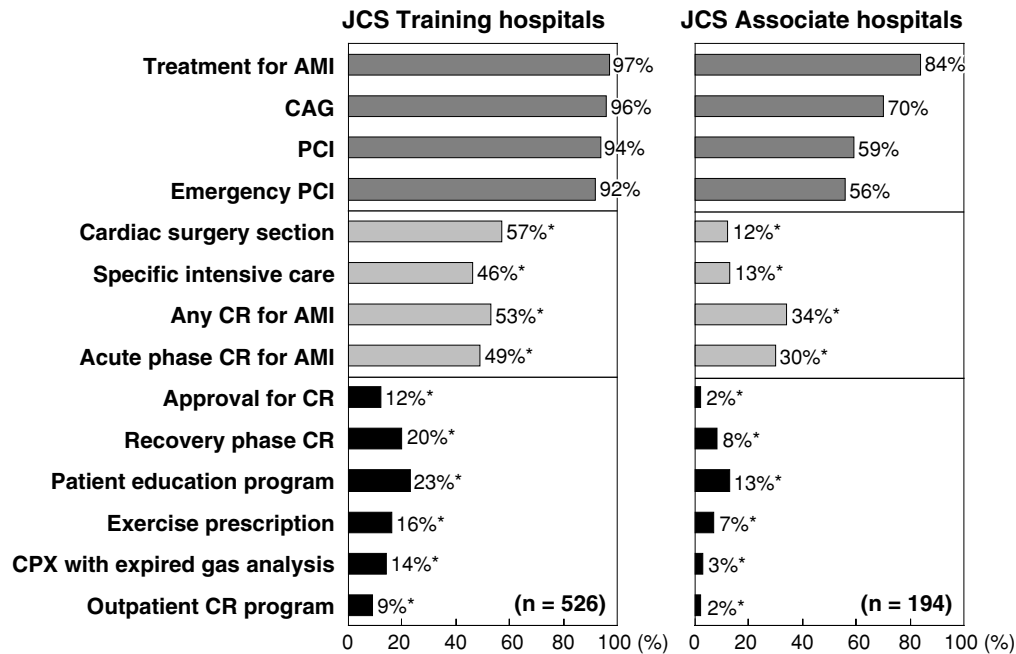


Fig 1. Implementation rates of various types of medical care for AMI in cardiology training hospitals authorized by the JCS. The implementation rates of care related to CR were remarkably low compared with the very high implementation rates of invasive procedures in both training and associate hospitals. JCS, Japanese Circulation Society; AMI, acute myocardial infarction; CAG, coronary arteriography; PCI, percutaneous coronary angioplasty; CR, cardiac rehabilitation; CPX, cardiopulmonary exercise test. * $p < 0.01$ compared with the implementation rate of emergency PCI in each hospital category.

Table 3 Estimation of Number of Patients and Participation Rates in CR in Japan

	Equation of estimation*	Estimated total in Japan (patients/year)	Estimated participation rate (%) [§]
Total number of hospitalized patients with AMI	$59.5 \times 859 + 19.1 \times 311 + 2.0 \times 7,075 =$	71,201	
No. of acute phase survivors [#]	$71,201 \times 0.9 =$	64,809	
Participation in any CR	$13.0 \times 859 + 4.1 \times 311 + 0.36 \times 7,075 =$	14,989	23.1
Participation in recovery-phase CR (patients/year)	$9.2 \times 859 + 1.5 \times 311 + 0.20 \times 7,075 =$	9,811	15.1
Participation in outpatient-CR in case of 100% transfer from recovery-phase CR	$5.7 \times 859 + 0.08 \times 311 + 0.0 \times 7,075 =$	4,896	7.6
Participation in outpatient-CR in case of 50% transfer from recovery-phase CR	$2.8 \times 859 + 0.04 \times 311 + 0.0 \times 7,075 =$	2,443	3.8

*Estimated total numbers in Japan were calculated as the sum of patients in 859 JCS training hospitals, 311 JCS associated hospitals, and 7,075 non-training hospitals.

[#]Acute-phase survival rate was assumed to be 90% according to previous reports (references 15 and 16).

[§]Estimated participation rate was calculated as the number of participants relative to the number of acute-phase survivors.

The rates of implementation of recovery-phase CR were 20% for TH, 8% for AH, and 2% for NTH, which were much lower than those for acute-phase CR. More importantly, only 9.3% of THs, 1.5% of AHs, and 0% of NTHs had outpatient CR programs for AMI patients.

Regarding the content of the CR program, patient education programs (23%, 13% and 2%), formulated exercise prescription based on exercise testing (16%, 7% and 1%), and cardiopulmonary exercise testing with expired gas analysis (14%, 3%, and 0%) were also only poorly implemented in each category of hospital (Table 2).

Fig 1 illustrates the rates of implementation of various types of medical care for AMI patients in the 526 THs and 194 AHs that participated in the present survey. In contrast to the very high rates of treatment of hospitalized AMI patients and implementation of invasive procedures such as emergency PCI, the implementation rates of recovery-phase CR and CR activities such as formulated exercise prescription and outpatient CR were all significantly lower in both

THs and AHs (all $p < 0.01$). Thus, the implementation rates of all CR activities were consistently and markedly lower than the implementation rates of invasive cardiac procedures in moderate to large-sized cardiology hospitals in Japan.

Participation Rate in CR After AMI

Patient participation rates in CR after AMI were calculated from the numbers of AMI survivors and participants in CR in each category (Table 2). The number of acute-phase hospital survivors of AMI was estimated by assuming the in-hospital mortality rate to be 10%, based on previous multicenter surveys that have reported the in-hospital mortality of AMI patients in Japan in 1998–2003 to be 9–11%.^{15,16} The number of patients who participated in outpatient CR after hospital discharge was estimated as the number of patients who participated in recovery-phase CR in the hospitals that also provided an outpatient CR program. When we assumed that all patients who participated in the in-hospital recovery-phase CR program also participated in the outpa-

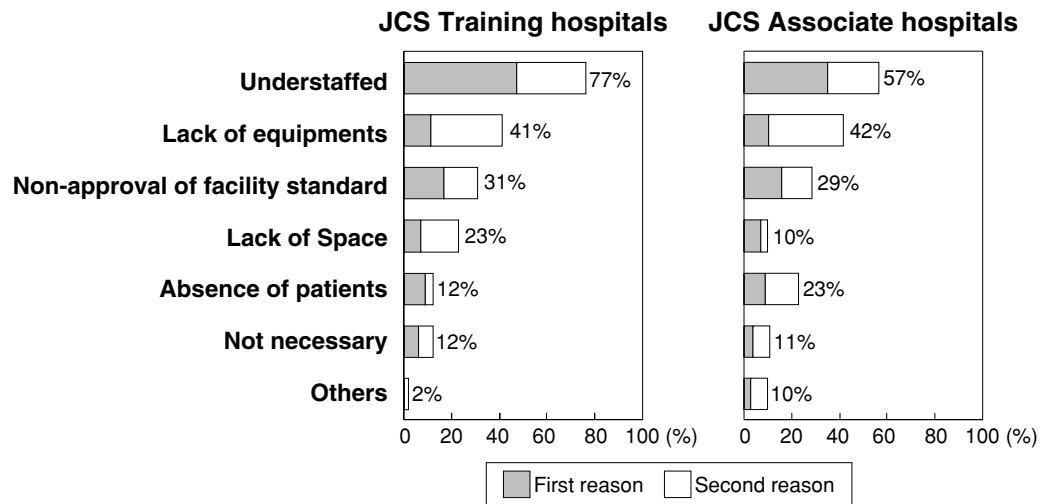


Fig 2. Reasons for not implementing cardiac rehabilitation (CR) in cardiology training hospitals authorized by the JCS. Data were collected from 222 of the 245 JCS training hospitals (Left) and 106 of the 128 JCS associate hospitals (Right) that were not performing any CR. The first and second reasons for non-implementation of rehabilitation were added. JCS, Japanese Circulation Society.

tient CR program of the same hospital when available (ie, a transfer rate of 100%), the participation rates of outpatient CR were only 10.6%, 0.4% and 0% among acute-phase survivors in THs, AHs, and NTHs, respectively. Furthermore, when we assumed the transfer rate from the in-hospital recovery-phase CR to outpatient CR to be 50%, the participation rates fell to 5.3%, 0.2%, and 0%, respectively.

From the data of this nationwide survey, the participation rates in CR after AMI in Japan were estimated. The numbers of patients who participated in any CR and recovery-phase CR after AMI in the whole of Japan in the year of 2003 were calculated from the average number of patients in each hospital in each category and the numbers of hospitals in the 3 categories (Table 3), yielding a total of 14,989 patients and 9,811 patients per year who participated in any CR and recovery-phase CR, respectively, in Japan. When we assumed that the transfer rates from the in-hospital recovery-phase CR to outpatient CR to be 100% and 50%, respectively, the number of participants in outpatient CR programs was estimated to be 4,896 and 2,443 patients/year, respectively, for the whole of Japan. When we assumed the acute-phase survival rate to be 90%;^{15,16} this yielded the acute-phase survivors (ie, denominator of CR participation rates) in Japan to be 64,809 patients/year. As a result, the estimated nationwide participation rates in any CR and recovery-phase CR were 23.1% and 15.1%, respectively, among the acute-phase survivors. Finally, the nationwide participation rate in outpatient CR was calculated to be only 3.8–7.6%, depending on a transfer rate from the in-hospital recovery-phase CR to outpatient CR after hospital discharge of 50–100% (Table 3).

Reasons for Non-Implementation of CR

In the present survey, 222 of the 245 THs and 106 of the 128 AHs that did not have any CR program for AMI gave reasons for not implementing rehabilitation (Fig 2). When the 1st and 2nd reasons were added, the 3 major reasons for non-implementation in both THs and AHs were lack of staff, lack of equipment and lack of achieving CR facility standards. The 4th reason was lack of CR space in THs, compared with lack of participating patients in AHs.

Discussion

Major Findings

This is the first nationwide survey of the implementation of CR for AMI patients in Japan. The major findings are: (1) in contrast to the broad dissemination of acute-phase invasive procedures for AMI, the implementation of recovery-phase and outpatient CR after AMI is extremely poor in Japan; the implementation rate of outpatient CR was only 9.3%, even in JCS THs, and the nationwide participation rate in outpatient CR was estimated to be only 3.8–7.6%; (2) the quality of CR programs reflected by implementation rates of patient education programs and exercise prescriptions based on exercise testing was also poor; and (3) the major reasons for not implementing CR were lack of staff, equipment and space, and not achieving the CR facility standards. These data clearly indicate that recovery-phase and outpatient CR for AMI is severely underutilized in Japan.

Hospital Implementation of CR in Japan

The present study has demonstrated that most THs and AHs in Japan are aggressively treating patients with AMI with invasive procedures such as emergency PCI, but that the implementation rates of all types of CR are disproportionately low relative to the high implementation rates of invasive procedures. In particular, THs have sufficient beds and staff cardiologists, an ICU and sufficient numbers of hospitalized AMI patients, so there seems to be no objective reason for not implementing CR for AMI.

A recent survey has reported that there are 2,621 CR programs in the USA,¹⁷ whereas according to the Japanese Association of Cardiac Rehabilitation, the number of hospitals approved for CR in Japan was only 186 in February 2005. This number accounted for only 15.9% of the total number (1,170 hospitals) of JCS-authorized THs (THs and AHs) that are treating 80% of all hospitalized AMI patients in Japan, and also accounted for only 15.0% of the 1,240 hospitals performing PCI according to the Japan Coronary Intervention Study!¹¹ Clearly, this small number of CR-approved hospitals is a major obstacle for the nationwide

spread of CR in Japan.¹²

From the present result, the number of hospitals that have an outpatient CR program is estimated to be only 85 in Japan ($859 \times 9.3\% + 311 \times 1.5\%$), which is even less than half of the CR-approved hospitals ($85/186 = 45.7\%$). In contrast, almost all of the 2,621 CR programs in the USA are conducted as outpatient programs.¹⁷ The length of hospital stay of AMI patients is rapidly decreasing because of early ambulation after aggressive reperfusion therapy (ie, less physical deconditioning) and the socioeconomic pressure on hospitals. Because the shorter hospital stay prevents patients from receiving enough education and instruction on life-style modification for secondary prevention, there is an increasing need for outpatient CR after discharge.^{2,18} Even when the smaller population ($\approx 1/2$) and the lower disease prevalence ($\approx 1/5$) in Japan than in the USA are taken into account, the number of the facilities for outpatient CR in Japan (approximately 1/30) is disproportionately small.

Patient Participation Rate in CR in Japan

The patient participation rates in the present survey can be compared with those in a previous report¹² which estimated the participation rate of recovery-phase CR in 1996–1998 to be 12% in JCS THs and 5% in all hospitals in Japan. The present result of a participation rate of 17.2% in THs in 2003 is slightly higher, but largely in accordance with the previous report, indicating that the participation rate in CR is slowly increasing but remains low in JCS THs. On the other hand, the nationwide participation rate in recovery-phase CR of 15.1% is higher than the previous estimation of 5%¹² possibly because of an increase in the proportion of patients hospitalized in THs or an increase in the implementation of recovery-phase CR in NTHs.

The low patient participation rate of 3.8–7.6% in outpatient CR in the whole of Japan (Table 3) is in accordance with the low implementation rate of outpatient CR programs. This is the first assessment of the patient participation rate in outpatient CR in Japan. Because the proportion of patients who subsequently participate in the outpatient CR program among the initial participants in the in-hospital CR program (ie, the transfer rate) is usually less than 50%, the estimated lower rate of 3.8% could even be overestimated. In the United States, the participation rate of AMI patients in phase II (usually outpatient-type) CR has been reported to be 11–47%,^{19–23} and a recent community survey reported an even higher participation rate of 55% in Omland County, Minnesota.²⁴ Therefore, it is clear that the patient participation rate in outpatient CR is markedly lower in Japan than in the USA. Because the role of post-AMI outpatient CR is rapidly emerging in the era of short hospital stay, it is critically important to urgently increase both the number of CR-approved facilities and the patient participation rates in outpatient CR in Japan.

Quality of Care in CR

The present survey has revealed that the standard procedures in CR, such as patient education programs, exercise prescription based on exercise tests, and cardiopulmonary exercise tests with expiratory gas analysis, are poorly implemented even in JCS THs in Japan (Fig 1). All these activities and procedures are important components of a comprehensive CR program.^{1,2,7,25} Therefore, not only an increase in the implementation rate but also an enhancement of the quality of care in CR should be aimed for in Japan. Thus, future surveys should assess not only the

implementation of exercise training but also the implementation of these comprehensive activities in CR.

Reasons for Non-Implementation of CR

The reasons for not implementing CR in THs were lack of staff, lack of equipments, lack of achieving approval for a CR facility, and lack of CR space. Before this survey, the difficulty in fulfilling the CR facility standards had been thought to be the main reason for the low implementation rate of CR in Japan. However, THs are usually large, general hospitals that would be expected to have sufficient staff, equipment and space. In addition, the present result that 73% (175/240) of THs that had been approved for specific intensive care did not have approval for CR despite their ability to fulfill the CR facility standards indicates that there are reasons other than the CR facility standards for the non-implementation of CR in these hospitals.

Ades et al reported that according to multivariate analysis, the strength of the physician's recommendation for participation was the most powerful predictor of entry into CR by patients after AMI or coronary bypass surgery.²⁰ Thus, physicians' reluctance or ignorance regarding CR after AMI might be a reason for the low implementation rate of CR in Japan. Because the CR facility standards in Japan have been loosened in 2004 and 2006, the motivation of both physicians and the hospitals would be a critically important factor for the implementation of CR.

Because the beneficial effects of CR on exercise capacity, coronary risk factor reduction, quality of life, and prognosis (cardiovascular mortality and total mortality) in patients after AMI have been established,^{1–7,26} the low implementation rate of CR implies that patients are not participating in CR for reasons unrelated to their physical conditions. Thus, efforts should be made urgently to increase the implementation rate of CR in Japan. To achieve this goal, it appears necessary to increase the number of hospitals approved for CR and to enhance physicians' understanding of the benefits of CR after AMI.

Study Limitations

This was a hospital-based survey using a questionnaire, so the reliability of data depends on the accuracy of diagnosis and the patient statistics in the surveyed hospitals. However, the close agreement of the estimated total number of hospitalized AMI patients in the present survey in 2003 (71,201 patients) and that of the previous nationwide survey in 2000 (66,459 patients)¹⁴ suggests that the data collected in the present survey are reliable.

The relatively low response rate (59%) in the present survey compared with the previous survey¹⁴ might have yielded a potential statistical bias. However, similar or even lower response rates have been reported in other nationwide surveys.^{27,28} In addition, when the hospitals that replied and those that did not reply were compared, there were no significant differences in the numbers of total hospital beds (THs: Reply 467 ± 258 beds vs No-reply 446 ± 241 beds, NS; AHs: Reply 262 ± 133 beds vs No-reply 275 ± 141 beds, NS; NTHs: Reply 138 ± 114 beds vs No-reply 143 ± 111 beds, NS) or in the regional distribution (ie, north-east or southwest Japan, urban or rural areas) between the 2 hospital groups, suggesting that a statistical bias caused by the low reply rate should be negligible.

Because the present survey did not investigate the actual numbers of acute-phase survivors and participants in outpatient CR in each hospital, the participation rate in outpatient

CR had to be estimated on the basis of some assumptions. However, because we used assumptions that would lead to higher participation rates, the results should be biased, if anything, toward overestimation, rather than underestimation of participation rates. Even with the possible overestimation, the participation rates in all CR in Japan were extremely low.

Conclusion

This first nationwide survey of CR demonstrated that, in contrast to the broad dissemination of acute-phase PCI for AMI, the implementation of recovery-phase CR, especially outpatient CR, is extremely poor in Japan. In addition, patient education programs and exercise prescriptions based on exercise testing are only poorly implemented. Considering the established benefits of CR in patients with AMI, urgent efforts should be made to improve this marked underutilization of recovery-phase and outpatient CR in Japan.

Acknowledgements

This study was supported in part by a Research Grants for Cardiovascular Diseases (15A-2) from the Ministry of Health, Labor and Welfare, Japan.

We greatly thank the directors and staff of the 1,059 hospitals for their cooperation in the conducting of this survey.

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Appendix 1

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