



Inter-Facility Transfer vs. Direct Admission of Patients With ST-Segment Elevation Acute Myocardial Infarction Undergoing Primary Percutaneous Coronary Intervention

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Background: Inter-facility transfer for primary percutaneous coronary intervention (PCI) from referring facilities to PCI centers causes a significant delay in treatment of ST-segment elevation acute myocardial infarction (STEMI) patients undergoing primary PCI. However, little is known about the clinical outcomes of STEMI patients undergoing inter-facility transfer in Japan.

Methods and Results: In the CREDO-Kyoto acute myocardial infarction (AMI) registry that enrolled 5,429 consecutive AMI patients in 26 centers in Japan, the current study population consisted of 3,820 STEMI patients who underwent primary PCI within 24 h of symptom onset. We compared long-term clinical outcomes between inter-facility transfer patients and those directly admitted to PCI centers. The primary outcome measure was a composite of all-cause death or heart failure (HF) hospitalization. There were 1,725 (45.2%) inter-facility transfer patients, and 2,095 patients (54.8%) with direct admission to PCI centers. The cumulative 5-year incidence of death/HF hospitalization was significantly higher in the inter-facility transfer patients than in those with direct admission (26.9% vs. 22.2%; log-rank $P < 0.001$). After adjusting for potential confounders, the risk for death/HF hospitalization was significantly higher (adjusted hazard ratio: 1.22, 95% confidence interval: 1.07–1.40, $P < 0.001$) in the inter-facility transfer patients than in those directly admitted.

Conclusions: Inter-facility transfer was associated with significantly worse long-term clinical outcomes for patients with STEMI undergoing primary PCI. (*Circ J* 2016; **80**: 1764–1772)

Key Words: Angioplasty; Myocardial infarction; Reperfusion

Primary percutaneous coronary intervention (PCI) has replaced fibrinolysis as the preferred reperfusion strategy in ST-segment elevation acute myocardial infarction (STEMI) patients if it is performed in a timely fashion.^{1,2} The efforts to minimize door-to-balloon (DTB) time achieved a temporal decrease in DTB time in the USA, but an expected mortality reduction has so far not been observed.^{3,4} The focus of minimizing ischemic time in STEMI has, therefore, moved

from only hospital delay in the DTB time to total ischemic time including prehospital delay.^{5–9} Inter-facility transfer for primary PCI from referring facilities to PCI-capable facilities may cause a significant treatment delay for STEMI patients undergoing primary PCI. The American College of Cardiology Foundation/American Heart Association (ACC/AHA) guidelines for STEMI recommend transport directly to a PCI-capable facility for primary PCI as Class 1 (level of evidence

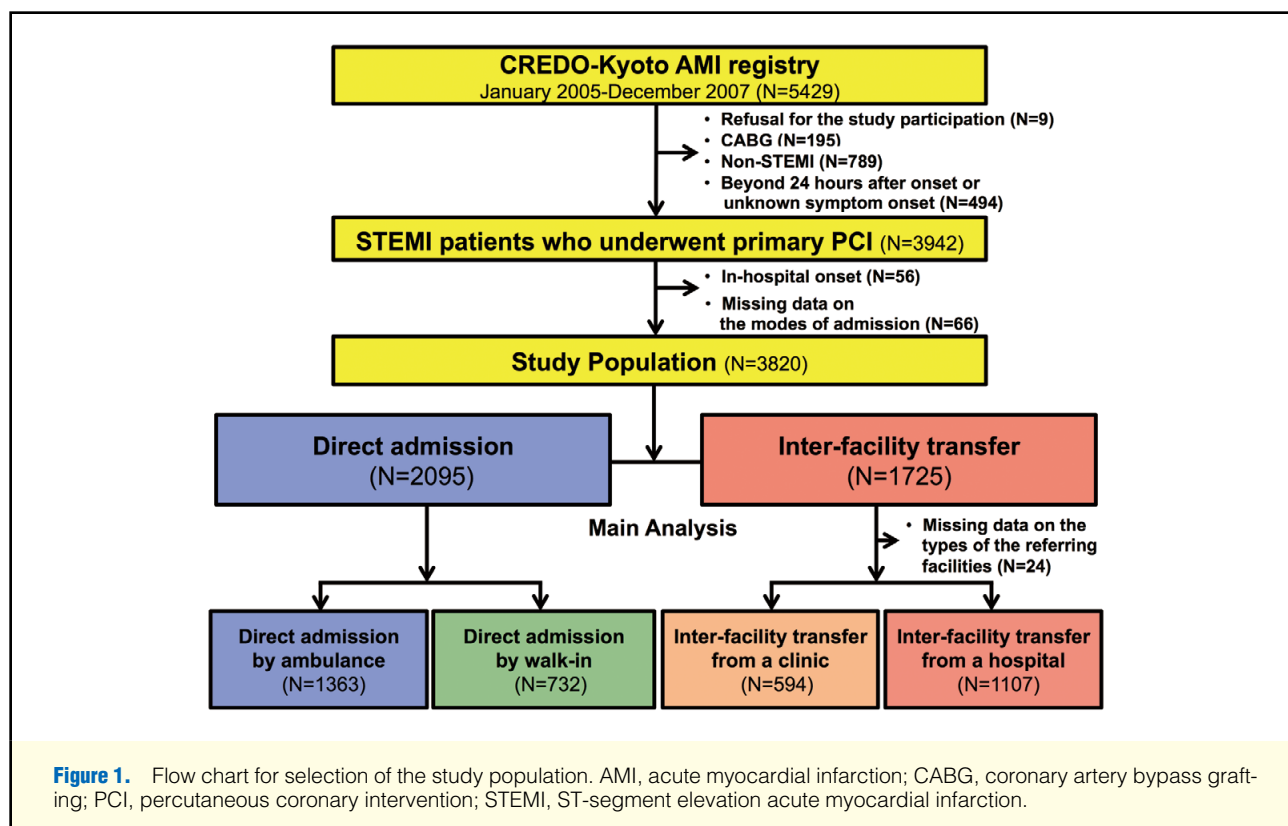
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B).¹ Approximately 20–45% of STEMI patients, however, were reported to having been initially admitted to a referring facility and subsequently transferred to PCI-capable facilities for primary PCI.^{10–20} Several previous studies have reported the outcomes of STEMI patients having inter-facility transfer as compared with those with direct admission, but the results are inconsistent because of the range of treatment delays caused by inter-facility transfer, the different risk profiles of the patients and the different sizes of the studies.^{10–20} The purpose of the present study, therefore, was to evaluate the influence of inter-facility transfer on long-term clinical outcomes of STEMI patients who underwent primary PCI, using a large observational database of patients with acute myocardial infarction (AMI) in Japan.

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Methods

The Coronary REvascularization Demonstrating Outcome Study in Kyoto (CREDO-Kyoto) AMI registry is a physician-initiated non-company-sponsored multicenter registry that enrolled consecutive patients with AMI who underwent coronary revascularization within 7 days of the onset of symptoms between January 2005 and December 2007 at 26 hospitals in Japan (Appendix S1). The relevant review board or ethics committee at all 26 participating hospitals approved the study protocol. Obtaining written informed consent from the patients was waived because of the retrospective nature of the study; however, we excluded those patients who refused participation in the study when contacted at follow-up. This strategy is concordant with the guidelines of the Japanese Ministry of Health, Labor and Welfare. The details on the design and

patient enrollment of this registry have been described previously.⁷ Among 5,429 patients enrolled in this registry, we excluded 9 patients who refused to participate in the study, 195 patients treated by coronary artery bypass grafting surgery, 789 patients with non-STEMI, 494 patients who underwent PCI beyond 24 h of symptom onset or whose symptom onset was unknown, 56 patients with in-hospital onset of STEMI, and 66 patients for whom the data on the mode of admission to the PCI center was not available (Figure 1). Therefore, the study population for the current analysis consisted of 3,820 STEMI patients who underwent primary PCI within 24 h of symptom onset. There were 1,725 inter-facility transfer patients (45.2%), and 2,095 patients (54.8%) directly admitted to PCI centers. Experienced clinical research coordinators from an independent clinical research organization (Research Institute for Production Development, Kyoto, Japan; Appendix S2) collected baseline data from the hospital charts or hospital databases according to prespecified definitions. Collection of follow-up information was mainly conducted through review of the inpatient and outpatient hospital charts by the clinical research coordinators, and additional follow-up information was collected through contact with patients, relatives and/or referring physicians by mail with questions regarding vital status, subsequent hospitalizations, and status of antiplatelet therapy. The transfer distance was calculated using the Advanced Core Technology Distance Calculation Worksheet for Excel®.

The inter-facility transfer group consisted of patients who were transferred for primary PCI from the referring facilities to a PCI center (participating centers), and the direct admission group consisted of those admitted directly to the PCI centers. The detailed definitions of baseline clinical characteristics are given in Supplementary Methods.

The primary outcome measure for the current analysis was a composite of all-cause death and heart failure (HF) hospitalization, consistent with our previous report.⁷ The secondary outcome measures included all-cause death, cardiac death, and HF hospitalization. Death was regarded as cardiac in origin unless obvious non-cardiac causes could be identified. Any death during hospitalization for the index AMI was regarded as cardiac death. HF hospitalization was regarded as present when intravenous drug treatment was administered for worsening HF during hospitalization. Death, cardiac death, and HF hospitalization were adjudicated by the clinical event committee (Appendix S3).

Statistical Analysis

We present continuous variables as mean $\pm$ standard deviation or median with interquartile range [IQR], and categorical variables as numbers and percentages. We compared continuous variables with Student's t-test or Wilcoxon rank-sum test on the basis of the distributions. We compared categorical variables with the χ^2 test when appropriate; otherwise, we used Fisher's exact test. We used the Kaplan-Meier method to estimate cumulative incidences of clinical event rates and assessed differences with the log-rank test. The effects of inter-facility transfer relative to direct admission for individual endpoints

were expressed as hazard ratios with 95% confidence intervals by multivariable Cox proportional hazard models adjusting for the 39 clinically relevant factors indicated in Table 1. Consistent with our previous reports, continuous variables were dichotomized using clinically meaningful reference values or median values. To further investigate the effect of the mode of admission to the PCI centers on long-term clinical outcomes, we subdivided the patients into 4 groups: direct admission (by ambulance or walk-in) and inter-facility transfer (from a hospital or a clinic). The effects of walk-in, transfer from a hospital, and transfer from a clinic were evaluated using direct admission by ambulance as the reference in the same multivariable Cox proportional hazard models with dummy variables. Statistical analyses were conducted using JMP 10.0 (SAS Institute Inc, Cary, NC, USA). All the statistical analyses were 2-tailed. We regarded $P < 0.05$ as statistically significant.

Results

Among the 1,725 patients who were transferred from referring facilities to the PCI centers, the median inter-facility transfer distance was 8.5 (IQR: 3.7–20.5) km. The majority of inter-facility transfer patients were transferred to relatively nearby PCI centers in the present study (≤ 20 km in 74% of patients)

Table 1. Baseline Clinical Characteristics, Procedural Characteristics and Discharge Medications of STEMI Patients Undergoing PCI

	Direct admission (n=2,095)	Inter-facility transfer (n=1,725)	P value
Baseline characteristics			
Age (years)	66.5 $\pm$ 12.2	68.6 $\pm$ 12.3	<0.001
≥75 years*	577 (28)	599 (35)	<0.001
Male sex*	1,610 (77)	1,214 (70)	<0.001
BMI <25.0 (kg/m ²)*	1,481 (71)	1,275 (74)	0.03
Hypertension*	1,635 (78)	1,349 (78)	0.91
Diabetes mellitus	647 (31)	561 (33)	0.74
Treated with insulin*	86 (4.1)	74 (4.3)	0.78
Current smoker*	875 (42)	681 (39)	0.15
HF*	653 (32)	529 (31)	0.74
Mitral regurgitation grade 3/4*	67 (3.2)	39 (2.3)	0.08
Ejection fraction $\leq$ 40%	266 (16)	224 (17)	0.37
Previous MI*	235 (11)	102 (5.9)	<0.001
Previous stroke (symptomatic)*	175 (8.4)	154 (8.9)	0.53
Peripheral vascular disease*	68 (3.4)	48 (2.8)	0.41
eGFR (ml/min/1.73 m ²)	67.9 $\pm$ 22.5	71.1 $\pm$ 29.2	<0.001
eGFR <30, without hemodialysis*	72 (3.4)	84 (4.9)	0.03
Hemodialysis*	21 (1.0)	31 (1.8)	0.03
Atrial fibrillation*	191 (9.1)	162 (9.4)	0.77
Anemia (hemoglobin <11.0 g/dl)*	134 (6.4)	202 (12)	<0.001
Thrombocytopenia (platelets <100 $\times$ 10 ⁹ /L)*	41 (2.0)	27 (1.6)	0.36
Chronic obstructive pulmonary disease *	76 (3.6)	51 (3.0)	0.25
Liver cirrhosis*	53 (2.5)	34 (2.0)	0.25
Malignancy*	177 (8.5)	117 (6.8)	0.055
Presentation			
Hemodynamics			
Killip class 1	1,554 (74)	1,306 (75)	0.02
Killip class 2	159 (7.6)	155 (9.0)	
Killip class 3	49 (2.3)	46 (2.7)	
Killip class 4*	333 (16)	218 (13)	
Intra-aortic balloon pump use	357 (17)	260 (15)	0.10

(Table 1 continued the next page.)

	Direct admission (n=2,095)	Inter-facility transfer (n=1,725)	P value
Angiographic characteristics			
Infarct-related artery location			
Left anterior descending artery	944 (45)	818 (47)	0.009
Left circumflex artery	222 (11)	157 (9.1)	
Right coronary artery	856 (41)	716 (42)	
Left main coronary artery	57 (2.7)	31 (1.8)	
Coronary artery bypass graft	16 (0.8)	3 (0.2)	
Multivessel disease*	1,133 (54)	892 (52)	0.14
No. of target lesions	1.38±0.67	1.42±0.74	0.08
Target of proximal left anterior descending artery*	1,114 (53)	969 (56)	0.06
Target of unprotected left main coronary artery*	80 (3.8)	51 (3.0)	0.15
Target of chronic total occlusion*	62 (3.0)	60 (3.5)	0.36
Target of bifurcation*	520 (25)	476 (28)	0.052
Side-branch stenting*	55 (2.6)	61 (3.5)	0.10
Total stent length >28 mm*	792 (41)	689 (43)	0.20
Minimum stent size <3.0 mm*	554 (29)	545 (34)	<0.001
Drug-eluting stent use (culprit or other lesion)*	594 (28)	515 (30)	0.31
Drugs at discharge			
Antiplatelet therapy			
Thienopyridine	1,984 (95)	1,662 (96)	0.02
Ticlopidine	1,835 (93)	1,511 (91)	0.08
Clopidogrel	148 (7.5)	151 (9.1)	0.08
Aspirin	2,059 (98)	1,703 (98.7)	0.27
Cilostazol*	675 (32)	688 (40)	<0.001
Other medications			
Statins*	1,185 (55)	895 (52)	0.004
β-blockers*	937 (45)	644 (37)	<0.001
ACEI/ARB*	1,542 (74)	1,236 (72)	0.18
Nitrates*	552 (26)	563 (33)	<0.001
Calcium-channel blockers*	434 (21)	325 (19)	0.15
Nicorandil*	648 (31)	440 (26)	<0.001
Warfarin*	236 (11)	172 (10)	0.20
Proton pump inhibitors*	705 (34)	590 (34)	0.72
H ₂ -blockers*	663 (32)	617 (36)	0.007

*Potential independent variables selected for Cox proportional hazard models. Categorical variables are expressed as n (%) unless otherwise indicated. Continuous variables are shown as mean ± standard deviation or median (interquartile range). ACEI, angiotensin-converting enzyme inhibitors; ARB, angiotensin-receptor blockers; BMI, body mass index; eGFR, estimated glomerular filtration rate, calculated by the Modification of Diet in Renal Disease formula modified for Japanese patients; HF, heart failure; MI, myocardial infarction; PCI, percutaneous coronary intervention; STEMI, ST-segment elevation acute MI.

(Figure 2). Baseline clinical characteristics were different in several important aspects between the inter-facility transfer and direct admission groups. The inter-facility transfer group had a significantly higher prevalence of patients with advanced age and anemia, while the direct admission group had significantly more patients with prior MI, male sex, renal dysfunction, and malignancy. The prevalence of cardiogenic shock was significantly higher in the direct admission group than in the inter-facility transfer group (Table 1). Regarding medical treatment at discharge, β-blockers and nicorandil were more often prescribed in the direct admission group, whereas thienopyridine, nitrates, and H₂-blockers were more often prescribed in the inter-facility transfer group (Table 1). Onset-to-presentation (to the PCI center) time was significantly longer in the inter-facility transfer group than in the direct admission group, while DTB time was significantly shorter in the inter-facility transfer group than in the direct admission group. Ultimately, onset-to-balloon (OTB) time was significantly longer in the inter-facility transfer group than in the direct admission group

(Figure 3).

Median follow-up duration for the surviving patients was 5.0 (IQR: 4.1–5.9) years (direct admission group: 5.0 (4.1–5.9) years; inter-facility transfer group: 4.9 (1.0–5.9) years, $P=0.003$). Complete 1-, 3- and 5-year follow-up information was obtained in 98.3%, 96.1%, and 70.2% of the patients, respectively. Compared with the direct admission group, the cumulative 5-year incidence of death/HF hospitalization was significantly higher in the inter-facility transfer patients than in those with direct admission (Figure 4). After adjusting for potential confounders, the excess risk of inter-facility transfer relative to direct admission for death/HF hospitalization was significant (Table 2). Inter-facility transfer as compared with direct admission was also associated with significantly higher risk of death and with a trend for higher risk of cardiac death (Table 2). The unadjusted and adjusted risks for HF hospitalization were not significantly different between the 2 groups (Table 2).

Among the 1,725 patients in the inter-facility transfer group, 1,107 were transferred from a hospital and 594 from a clinic.

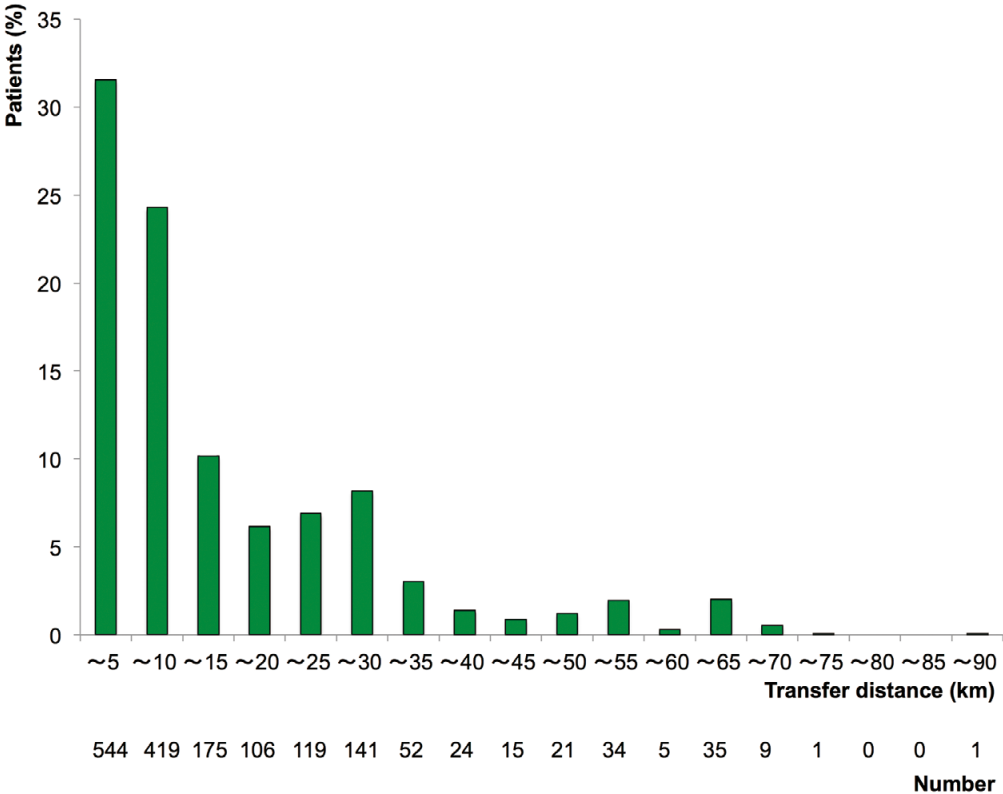


Figure 2. Distribution of inter-facility transfer distance.

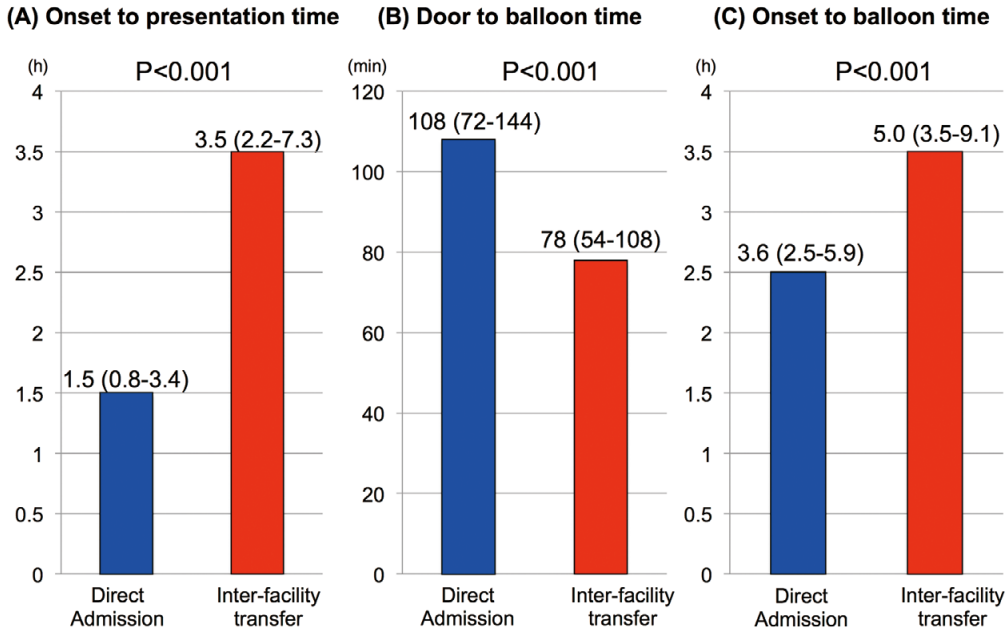


Figure 3. (A) Onset-to-presentation, (B) door-to-balloon and (C) onset-to-balloon time: direct admission vs. inter-facility transfer.

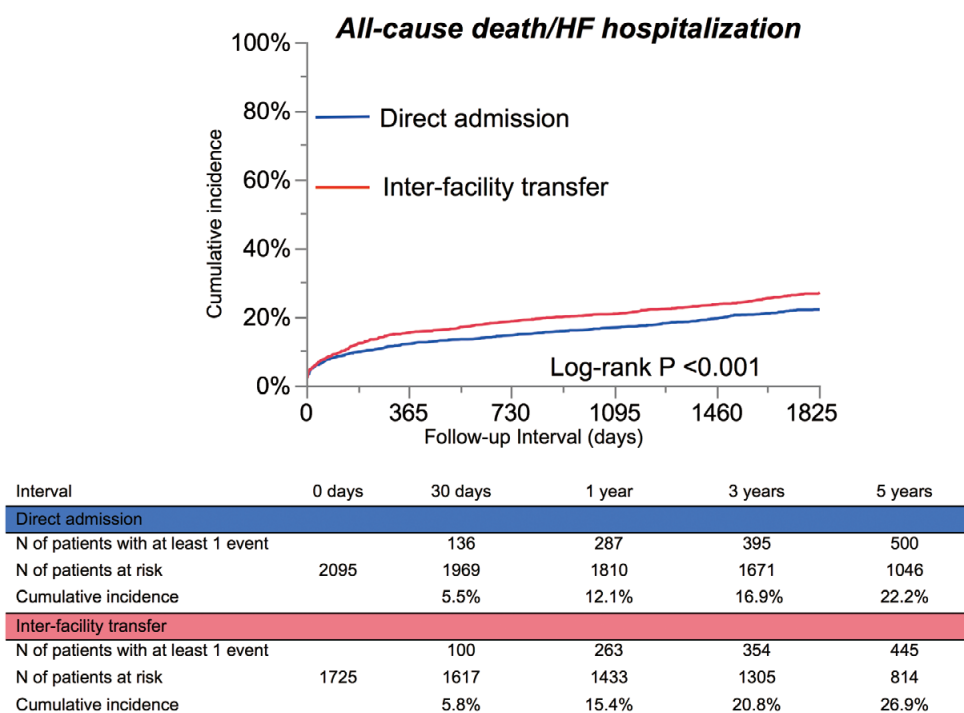


Figure 4. Cumulative 5-year incidence of the composite of death or heart failure (HF) hospitalization compared between direct admission and inter-facility transfer.

Table 2. Cardiac Enzymes and Clinical Outcomes at 5 Years: Direct Admission vs. Inter-Facility Transfer of STEMI Patients Undergoing PCI

	Direct admission (n=2,095)	Inter-facility transfer (n=1,725)	P value	Adjusted		P value
				HR	95% CI	
Peak cardiac enzymes						
Peak CPK (IU/L)	2,253 (1,145–4,167)	2,473 (1,199–4,569)	0.02	–	–	–
Peak CK-MB (IU/L)	192 (91–371)	196 (88–347)	0.16	–	–	–
Clinical outcomes						
All-cause death/HF hospitalization	500 (22.2%)*	445 (26.9%)*	<0.001	1.22	(1.07–1.40)	0.003
All-cause death	386 (17.7%)*	400 (22.2%)*	<0.001	1.23	(1.05–1.44)	0.01
Cardiac death	231 (10.7%)*	228 (12.9%)*	0.03	1.20	(0.98–1.48)	0.08
HF hospitalization	163 (8.4%)*	134 (8.6%)*	0.77	1.12	(0.86–1.44)	0.40

*Number of patients with event (cumulative 5-year incidence). CI, confidence interval; CPK, creatine phosphokinase; HR, hazard ratio. Other abbreviations as in Table 1.

Among the 2,095 patients in the direct admission group, 1,363 and 732 patients, respectively, were admitted to the PCI centers by ambulance and by walk-in. The baseline clinical characteristics were mostly similar between the 2 inter-facility transfer groups (from a hospital or a clinic) and between the 2 direct admission groups (by ambulance or by walk-in) (Table S1). Regarding hemodynamics, however, the “direct admission by ambulance” group and the “inter-facility transfer from a hospital” group, respectively, included more patients with hemodynamic compromise such as cardiogenic shock and mechanical support use than the “direct admission by walk-in” group and the “inter-facility transfer from a clinic” group (Table S1). The onset-to-presentation (to the PCI centers) time in the

“direct admission by ambulance” group was markedly shorter than in the other 3 groups (Figure S1). On the other hand, DTB time in the “direct admission by walk-in” group was much longer than in the other 3 groups (Figure S1). Finally, the total ischemic time as represented by OTB time was markedly shorter in the “direct admission by ambulance” group than in the other 3 groups (Figure S1).

Reflecting the low-risk profile of patients included, the cumulative 5-year incidences of death/HF hospitalization were low in the “direct admission by walk-in” and “inter-facility transfer from a clinic” groups (Figure 5). The cumulative 5-year incidence of death/HF hospitalization in the “inter-facility transfer from a hospital” group was much higher than that in

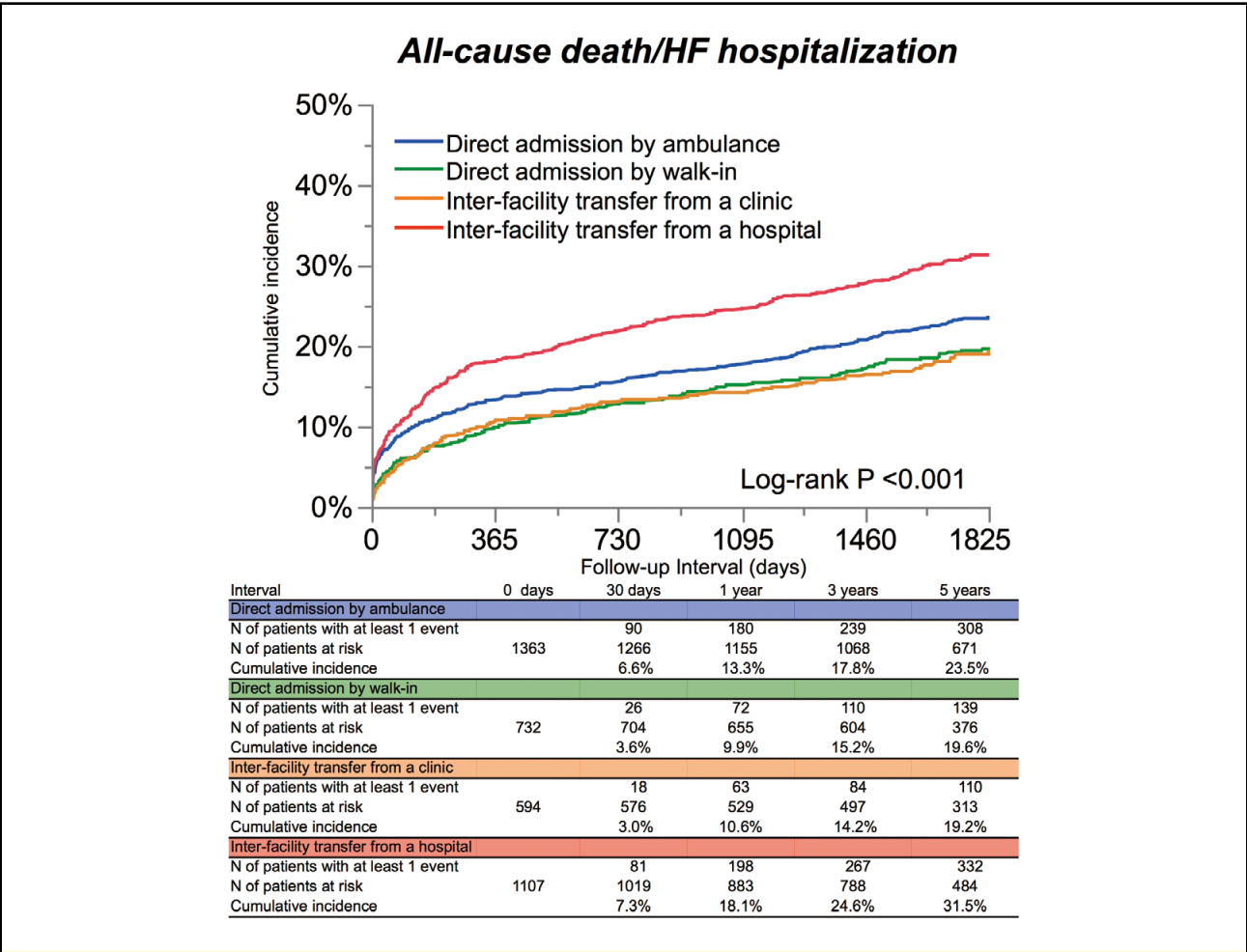


Figure 5. Cumulative 5-year incidence of the composite of death or heart failure (HF) hospitalization compared according to the mode of admission to the PCI center: direct admission by ambulance or by walk-in and inter-facility transfer from a clinic or a hospital. PCI, percutaneous coronary intervention.

the “direct admission by ambulance” group (Figure 5). The excess risk of the “inter-facility transfer from a hospital” group relative to the “direct admission by ambulance” group remained significant after adjusting for confounders (Tables 3,S2–S5).

Discussion

The main finding in the current study was that inter-facility transfer for primary PCI was associated with significantly longer total ischemic time and worse long-term clinical outcomes for STEMI patients.

Inter-facility transfer for primary PCI incurred a 84-min treatment delay as compared with direct admission to the PCI centers, resulting in significantly increased long-term risks of inter-facility transfer relative to direct admission for the composite of death/HF hospitalization and all-cause death in the current study. In the current study, 45.2% of STEMI patients were transferred from referring facilities for primary PCI in Japan where nearby PCI centers are available, particularly in urban areas.²¹ Several previous studies also reported that 20–45% of STEMI patients were initially admitted to a referring facility and then transferred to PCI-capable facilities for primary PCI.^{10–20} The clinical effect of inter-facility transfer

relative to direct admission in those studies was inconsistent. Some research has found that STEMI patients with inter-facility transfer were at increased risk of death after STEMI,^{15–17,20} though others have not confirmed this finding.^{10–14,18,19} However, many previous studies evaluating the clinical effect of inter-facility transfer for primary PCI report a treatment delay of around 60 min. In line with the current study, only 13% of inter-facility transfer patients were reported to be treated with PCI within 90 min of arrival at non-PCI centers.²² To avoid treatment delay caused by inter-facility transfer for primary PCI and to increase the rate of direct admission by ambulance therefore, prehospital diagnosis of STEMI and direct admission to a PCI center by ambulance should be pursued. Le May et al reported that inter-hospital transfer patients were associated with significantly increased mortality rates at 180 days as compared with those with direct admission by ambulance after a prehospital 12-channel ECG.¹⁶ Fosbøl et al also reported that using prehospital ECG and then bypassing geographically closer hospitals without primary PCI capabilities was associated with shorter total ischemic times and 3-fold greater likelihood of achieving the guideline target of <90 min from first medical contact to PCI.¹⁸ This strategy has been implemented in several countries,^{5,14} and has been proposed as one of the

Table 3. Clinical Outcomes According to the Mode of Admission to PCI Center

	No. of patients with event (cumulative 5-year incidence, %)	Log-rank P value	Adjusted		P value
			HR	95% CI	
All-cause death/HF hospitalization		<0.001			
Direct admission by ambulance	308 (23.5)		1 (Reference)		
Direct admission by walk-in	139 (19.6)		1.09	(0.88–1.34)	0.44
Inter-facility transfer from a clinic	110 (19.2)		1.00	(0.79–1.25)	0.99
Inter-facility transfer from a hospital	332 (31.5)		1.42	(1.20–1.68)	<0.001
All-cause death		<0.001			
Direct admission by ambulance	255 (19.7)		1 (Reference)		
Direct admission by walk-in	98 (14.0)		0.95	(0.75–1.21)	0.70
Inter-facility transfer from a clinic	82 (14.5)		0.90	(0.69–1.16)	0.42
Inter-facility transfer from a hospital	280 (26.6)		1.36	(1.13–1.63)	0.001
Cardiac death		<0.001			
Direct admission by ambulance	157 (12.1)		1 (Reference)		
Direct admission by walk-in	58 (8.3)		1.01	(0.72–1.38)	0.97
Inter-facility transfer from a clinic	44 (7.6)		0.90	(0.62–1.26)	0.54
Inter-facility transfer from a hospital	169 (16.1)		1.35	(1.07–1.72)	0.01
HF hospitalization		0.24			
Direct admission by ambulance	95 (8.1)		1 (Reference)		
Direct admission by walk-in	59 (9.0)		1.42	(0.99–2.01)	0.054
Inter-facility transfer from a clinic	37 (6.7)		0.96	(0.62–1.45)	0.86
Inter-facility transfer from a hospital	90 (10.0)		1.43	(1.05–1.95)	0.02

Abbreviations as in Tables 1,2.

measures to achieve more rapid reperfusion in STEMI.^{1,23}

Inter-facility transfer for primary PCI, on the other hand, will remain even after an increase in direct admissions by ambulance, because some STEMI patients will initially present at non-PCI facilities. In the current study, median transfer distance was only 8 km in the inter-facility transfer groups. Therefore, treatment delay caused by the transfer itself was quite short, and the majority of treatment delay might be caused by prolonged door-in door-out (DIDO) time. Both the current European Society of Cardiology/European Association for Cardio-Thoracic Surgery and the ACC/AHA clinical guidelines recommend that DIDO time <30 min should be implemented in non-PCI centers as a quality metric.^{1,2} However, Wang et al reported that only 11% of STEMI patients who were initially admitted to a non-PCI center have DIDO times less than the recommended 30 min.²⁴ To further improve the clinical outcome of STEMI patients, efforts to minimize DIDO time in non-PCI centers should also be pursued.

It was intriguing to note the differences in the baseline characteristics of the inter-facility transfer and direct admission groups. Patients with advanced age and anemia, who were more prevalent in the inter-facility transfer group, were more likely to have a home doctor or a local hospital to visit. On the other hand, patients with prior MI, who were more prevalent in the direct transfer groups, were more likely to know the symptoms of AMI and the importance of timely reperfusion by PCI, leading to their low threshold of calling the ambulance service. It is crucially important to expand the public campaign regarding the importance of making the total ischemic time as short as possible by lowering the threshold in calling an ambulance when having symptoms suggestive of AMI in order to improve the outcomes of STEMI patients.

Study Limitations

First, the study had the limitations inherent to observational

study design such as selection bias and unmeasured confounders, despite extensive statistical adjustment for potential confounders. The huge differences in the baseline characteristics of the study groups, including the prescription rate of evidence-based medicine such as β -blockers and angiotensin-converting enzyme inhibitors/angiotensin-receptor blockers, might influence the study results even after adjusting for potential confounders, including medications. Second, we did not know whether the inter-facility transfer patients were actually transferred to the referring facilities by ambulance or by walk-in. Furthermore, we did not have detailed data for these patients at the referring facilities, including DIDO time and the medical therapy. Third, precise data on transfer times were lacking because of the retrospective nature of the current study. Fourth, we did not have data on the attending physician after discharge (cardiologist or general physician). Finally, because the emergency medical service system and distribution of PCI centers in Japan may be different from those outside Japan, generalizing these results to populations outside Japan should be done with caution.

Conclusions

Inter-facility transfer was significantly associated with longer OTB time and worse long-term clinical outcomes of patients with STEMI undergoing primary PCI, although the majority of the inter-facility transfer patients were transferred from a relatively nearby referring facility in this cohort. Direct admission to PCI centers should be pursued to further improve the outcomes of STEMI patients.

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Conflict of Interest Statement

None of the authors has conflicts of interest to disclose regarding this study.

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Ethical Approval

The protocol for the study was approved by the human research ethics committees of the Kyoto University Graduate School of Medicine.

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Supplementary Files

Supplementary File 1

Supplementary Methods

Appendix S1. List of Participating Centers and Investigators for the CREDO-Kyoto AMI Registry

Appendix S2. List of Clinical Research Coordinators

Appendix S3. List of the Clinical Event Committee Members

Table S1. Baseline clinical characteristics: direct admission by ambulance vs. direct admission by walk-in vs. transfer from clinic vs. transfer from hospital

Table S2. Multivariable analysis for a composite of all-cause death and HF hospitalization in STEMI patients undergoing PCI

Table S3. Multivariable analysis for all-cause death of STEMI patients undergoing PCI

Table S4. Multivariable analysis for cardiac death of STEMI patients undergoing PCI

Table S5. Multivariable analysis for HF hospitalization of STEMI patients undergoing PCI

Figure S1. (A) Onset-to-presentation, (B) door-to-balloon and (C) onset-to-balloon time according to mode of admission to the percutaneous coronary intervention center.

Please find supplementary file(s);
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