Original Article

Safety of Early and Late Discharge in Patients with ST Elevation Myocardial Infarction after Primary Percutaneous Coronary Intervention

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Background: Primary percutaneous coronary intervention (PPCI) is now a standard treatment procedure for ST elevation myocardial infraction (STEMI) patients. Because of the many STEMI patients, there is a space constraint in coronary care unit, especially in Southeast Asian countries. Therefore, we practitioners should be evaluating if the patients could be safely discharged earlier. The current European Society of Cardiology STEMI 2017 guideline recommended early discharge in stable patients; however, the data are limited, especially in the Asian countries.

Objective: To determine the rate of 30-day, 1-year mortality, and readmission of STEMI patients that underwent PPCI and were discharged early within three days of admission, compared with the late discharge of more than three days after admission.

Materials and Methods: The present study was a retrospective cohort study at King Chulalongkorn Memorial Hospital. The authors collected consecutive cases of STEMI patients that underwent PPCI and were discharged between January 1999 and December 2015.The patients were divided into two groups as group 1 with early discharge within three days of admission and group 2 with late discharge more than three days of admission. The follow up on the mortality and readmission rates were collected at 30-day and 1-year after discharge.

Results: Out of 1,242 STEMI patients, 691 patients (55.6%) were classified in group 1 and 551 patients (44.4%) were in group 2. The 30-day mortality was 0.4% in group 1 compared with 1.3% in group 2 (HR 2.93, p=0.12) and 1-year mortality was 3.9% in group 1 compared with 8.0% in group 2 (HR 2.09, p=0.003). There was no difference in 30-day readmission between both groups at 1.3% versus 2.5% (OR 1.98, p=0.113), but there was a difference in 1-year readmission between the two groups at 4.5% versus 10.6% (OR 2.51, p<0.001). In multivariate analysis, the predictive factors for early discharged STEMI patients were male (adjusted OR 1.78, p=0.007), Killip classification 1, 2, and 3 (adjusted OR 5.85, p=0.001), EF greater than 40% (adjusted OR 2.51, p=0.001), and TIMI flow after PPCI 3 (adjusted OR 1.48, p=0.016).

Conclusion: Early discharge in STEMI patients within three days after PPCI is safe in terms of mortality and readmission compared to late discharge, especially in STEMI patients with Killip class I. Early discharge can provide more space for coronary care.

Keywords: STEMI; PPCI; Early discharge; Late discharge; Mortality; Readmission; Killip class

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Primary percutaneous coronary intervention (PPCI) is currently highly vital in ST elevation myocardial infarction (STEMI) patients because it obviously reduces the rates of mortality, disability, and disease complications compared to thrombolytic therapy[1-3]. The present guidelines recommend PPCI as the first line treatment for STEMI patients[1-3]. Because of the many STEMI patients, there is a space constraint in coronary care unit, especially in Southeast Asian countries. Therefore, if the patients could be safely discharged earlier, it would lessen this constraint. According to the current European Society of Cardiology (ESC) STEMI 2017 guidelines, early discharge is safe for low-risk patients, however, the safety data of early discharge in STEMI patients in Asian countries is limited[4-11].

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Objective

The proper duration of hospital admission after

PPCI for STEMI patients is a very important issue in the developing countries. The shorter duration means less expenses for both the patients and the government. It also increases the bed turnover rate resulting in the faster admission for new patients[6,12,13]. Thus, the study for proper admission duration after PPCI for STEMI patients to be discharged without any disease complications is very important in term of the less expenses for both patients and government as well as the better bed turnover rates. The present study was also important for the treatment procedures for STEMI patients regarding the proper admission duration after PPCI because there currently limited data on this issue.

The present study primary objective was to determine the rate of 30-day, 1-year mortality, and readmission for STEMI patients that underwent PPCI and were discharged early within three days of admission compared with the late discharge of more than three days after admission.

The secondary objective was to determine the factors that impact the admission duration for the STEMI patients underwent PPCI.

Materials and Methods

Study design and population

The present analytic cohort study was conducted at the internal medicine wards, King Chulalongkorn Memorial Hospital, Bangkok, Thailand. All the STEMI patients that underwent PPCI between January 1, 1999 and December 31, 2015, who survived to hospital discharged were included in the present study. Exclusion criteria were the STEMI patients who received thrombolytic, the STEMI patients who underwent thrombolytic and rescue percutaneous coronary intervention respectively, and the cardiac arrest STEMI patients.

The diagnosis of STEMI was based on the standard criteria. Patients were transferred from the ambulance directly to a pre-informed waiting team in the cardiac catheterization room and the culprit vessel revascularization was undertaken using the femoral artery or radial artery access, whenever possible.

Study protocol

The present study was a single center, retrospective cohort study. The authors collected the data of the STEMI patients that underwent PPCI form the IPD, OPD medical records, and the computerized database of King Chulalongkorn Memorial Hospital, Bangkok, Thailand. Baseline demographics, clinical presentation, procedure details, and complications were prospectively entered into the King Chulalongkorn Memorial Hospital computerized database at the end of each PCI procedure. Clinical data and discharge medications were updated on discharge.

The patients were classified into two groups on length of hospital stay with group 1 as early discharge within three days of admission and group 2 as late discharge with more than three days after admission.

Outcome measures

The main outcomes measure were all-cause mortality and readmission, on 30-day and 1-year post discharge. Mortality and readmission were assessed up to December 31, 2015, and patients follow up were censored at the time of death. The primary objectives were to determine the rate of 30-day and 1-year mortality, and readmission in STEMI patients that underwent PPCI and were discharged early within three days of admission compared with the late discharge more than three days after admission. The secondary objectives were to determine the factors that impacted the admission duration for the STEMI patients that underwent PPCI.

The present study was approved by the Institutional Review Board, Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand (IRB No. 300/59).

Statistical analysis

The statistical analyses were performed using IBM SPSS Statistics, version 22 (IBM Corp., Armonk, NY, USA). Baseline characteristics and all factors that affected the 30-day mortality, 1-year mortality, 30-day readmission, 1-year readmission, and early discharged STEMI patients were analyzed by Student t-test for continuous data, and Pearson chi-square test for categorical data. To compare the 30-day mortality, 1-year mortality, 30-day readmission, and the 1-year readmission in early and late discharged of the STEMI patients, logistic regression and cox regression were used. Survival functions for the early and late discharge groups were calculated using the Kaplan-Meier estimator and were contrasted using the log-rank statistic. The binary logistic regression analyses in the multivariate analysis were used to determine the independent factor that led to 30-day mortality, 1-year mortality, 30-day readmission, 1-year readmission, and early discharged of STEMI patients. The statistically significant difference was determined at p-value less than 0.05.

Results

Between January 1999 and December 2015, the 1,242 STEMI patients that underwent PPCI and were admitted to the internal medicine ward at King Chulalongkorn Memorial Hospital, Bangkok, Thailand were enrolled in the present study.

Out of the 1,242 STEMI patients (age 59.19±12.95, 76% male), 691 patients (55.6%) were classified in the early discharge within three days of admission (group 1), and 551 patients (44.4%) were in the late discharge of more than three days after admission (group 2). All-cause mortality rate was 3.8 per 100-person-year for all patients and were 2.6 per 100-person-year for group 1 versus 5 per 100-person-year for group 2 (p<0.001). The baseline characteristics of both groups are shown in Table 1. Mean age of patients was 57.93±12.75 in group 1, and 60.77±13.04 in group 2 (p<0.001). Mean ejection fraction (EF) was 53.13±12.83 and 47.93±13.49 in group 1 and group 2, respectively (p<0.001). Mean GFR of patients in group 1 was 83.07±24.93 and 74.05±29.11 in group 2 (p<0.001). The patients in group 2 had significantly more severe Killip classification as advance stage of chronic kidney disease (CKD), EF of 40% or less, age of 70 years or older, TIMI flow before PPCI of 0 or1, door to balloon times greater than 90 minutes, and level of triglyceride more than group 1.

Ten patients died within 30 days post discharge including three patients in the early discharge group and seven patients in the late discharge group. The 30-day mortality was 0.4% in group 1 compared with 1.3% in group 2 (HR 2.93, p=0.12) and 1-year mortality was 3.9% in group 1 compared with 8.0% in group 2 (HR 2.09, p=0.003). Figure 1 shows the Kaplan-Meir survival curves for early and late discharge groups. There was no difference in 30-day readmission between both groups at 1.3% versus 2.5% (OR 1.98, p-value=0.113), however, there was a difference in 1-year readmission between group 1 and group 2 at 4.5% versus 10.6% (OR 2.51, p<0.001).

In multivariate analysis, the predictive factors for early discharged STEMI patients were male (adjusted OR 1.78, p=0.007), Killip classification 1, 2, and 3 (adjusted OR 5.85, p=0.001), EF greater than 40% (adjusted OR 2.51, p=0.001), and TIMI flow after PPCI 3 (adjusted OR 1.48, p=0.016).

In subgroup analysis of patients with Killip class I, the baseline characteristics between both groups of patients with Killip class I are shown in Table 2. Eight hundred sixty-five STEMI patients with Killip class I underwent PPCI and survived to hospital discharged, 544 patients (63%) were in group 1 and 321 patients (37%) were in group 2. The patients in group 2 were significantly higher in advance stage of CKD, EF of 40% or less, age of 70 years or more, TIMI flow before PPCI 0 or 1, and door to balloon times greater than 90 minutes than group 1. All-cause mortality rate was three per 100-person-year for all patients and were 2.4 per 100-person-year in group 1 versus 3.8 per 100-person-year for group 2 (p=0.002). Only one patient in the early discharge group died within 30 days post discharge, and four patients in late discharge group died within 30 days post discharge. Patients presented with Killip class I in group 1 had lower 1-year mortality than group 2 at 2.8% versus 6.5% (HR 2.43, p=0.009), but no difference in 30-day mortality between both groups at 0.2% versus 1.3% (HR 6.79, p=0.087) (Table 3). Figure 2 shows the Kaplan-Meir survival curves for early and late discharge groups. Patients with Killip

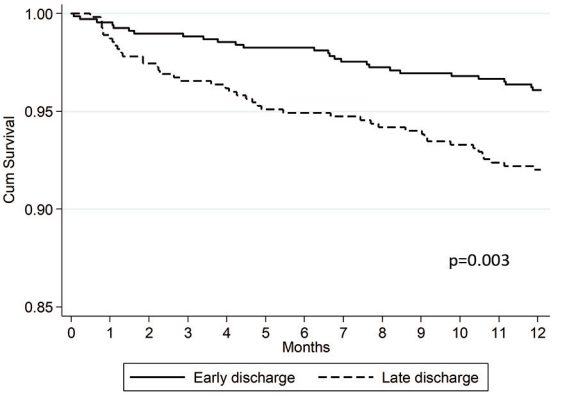

Figure 1. Kaplan-Meier survival curves for cumulative post-discharge survival in the early and late discharged ST elevation myocardial infarction patients.

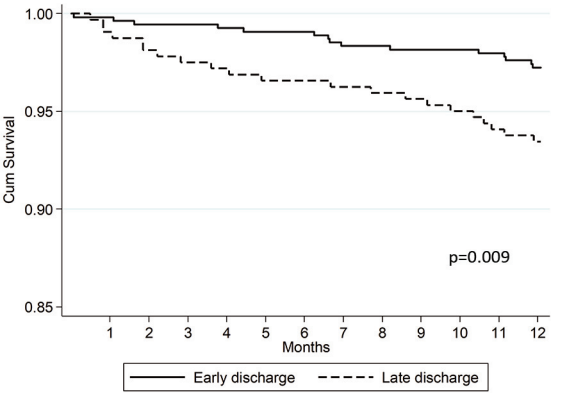

Figure 2. Kaplan-Meier survival curves for cumulative post-discharge survival in the early and late discharged ST elevation myocardial infarction patients in Killip class I.

Table 1. Baseline demographics and clinical characteristics

	Early discharge [n=691 (55.6)]; n (%)	Late discharge [n=551 (44.4)]; n (%)	p-value
Sex			
Male	552 (79.88)	394(71.51)	0.001
Female	139 (20.12)	157 (28.49)	
Age (years); mean±SD	57.93±12.75	60.77±13.04	<0.001
<70	561 (81.19)	410 (74.41)	0.004
≥70	130 (18.81)	141 (25.59)	
CKD (mL/minute/1.73 m^2); mean±SD	83.07±24.93	74.05±29.11	<0.001
Stage 1	194 (38.49)	86 (26.38)	<0.001
Stage 2	227 (45.04)	146 (44.79)	
Stage 3	75 (14.88)	76 (23.31)	
Stage 4, 5	8 (1.59)	18 (5.52)	
Cholesterol (mg/dL); mean±SD	207.91±55.13	201.46±55.51	0.069
≤200	264 (47.91)	231 (53.10)	0.106
>200	287 (52.09)	204 (46.90)	
TG (mg/dL); meadian (min, max)	125 (32, 4,317)	115 (20, 985)	0.009
≤200	111 (20.15)	63 (14.48)	0.021
>200	440 (79.85)	372 (85.52)	
HDL (mg/dL); mean±SD	42.29±15.80	43.50±14.07	0.211
<40	265 (48.18)	181 (41.71)	0.043
≥40	285 (51.82)	253 (58.29)	
LDL (mg/dL); mean±SD	136.90±45.41	131.93±50.03	0.105
≤130	264 (48.35)	222 (51.63)	0.309
>130	282 (51.65)	208 (48.37)	
Door to balloon time (minutes); meadian (min, max)	35 (3, 773)	57 (8, 1,818)	<0.001
≤90 minutes	556 (82.25)	358 (69.79)	<0.001
Total delay time (minutes); meadian (min, max)	299 (55, 3233)	330 (30, 12,580)	0.037
EKG: anterior	377 (54.56)	292 (52.99)	0.583
Vessel disease			
Single vessel	356 (64.73)	232 (60.26)	0.164
Multi vessels	194 (35.27)	153 (39.74)	
TIMI pre PCI			
TIMI=0 or 1	479 (69.32)	420 (76.23)	0.007
TIMI=2 or 3	212 (30.68)	131 (23.77)	
TIMI post PCI			
TIMI=0 or 1	2 (0.29)	19 (3.45)	<0.001
TIMI 2 or 3	689 (99.71)	531 (96.55)	
Killip classification			
1 to 3	635 (91.90)	417 (75.68)	<0.001
4	56 (8.10)	134 (24.32)	
Pain to balloon time: ≤6 hours	394 (57.69)	251 (47.36)	<0.001
DM	482 (72.59)	353 (66.23)	0.017
HT	339 (50.67)	240 (44.53)	0.034
Dyslipidemia	152 (23.79)	138 (26.74)	0.423
Smoking	338 (50.52)	283 (53.10)	0.375
Vessel infarction			
LAD	377 (54.56)	287 (52.09)	0.029
RCA	260 (37.63)	204 (37.02)	
LCX	53 (7.67)	50 (9.07)	
LM	0 (0.0)	7 (1.27)	
SVG	1 (0.14)	1 (0.18)	
LIMA	0 (0.0)	2 (0.36)	
Ejection fraction (%); mean±SD	53.13±12.83	47.93±13.49	<0.001
≤40	97 (16.81)	141 (31.13)	<0.001
>40	480 (83.19)	312 (68.87)	

CKD=chronic kidney disease; TG=triglyceride; HDL=high density lipoprotein; LDL=low density lipoprotein; EKG=electrocardiogram; PCI=percutaneous coronary intervention; DM=diabetes; HT=hypertension; LAD=left anterior descending artery; RCA=right coronary artery; LCX=left circumflex artery; LM=left main artery; SVG=saphenous vein graft; LIMA=left internal mammary artery; SD=standard deviation

Table 2. Baseline demographics and clinical characteristics of Killip class I ST elevation myocardial infarction patients

	Early discharge [n=544 (63)]; n (%)	Late discharge [n=321 (37)]; n (%)	p-value
Sex			
Male	436 (80.15)	241 (75.08)	0.081
Female	108 (19.85)	80 (24.92)	
Age (years); mean±SD	57.08±12.37	59.90±13.10	0.002
<70	455 (83.64)	239 (74.45)	0.001
≥70	89 (16.36)	82 (25.55)	
CKD (mL/minute/1.73 m^2); mean±SD	86.41±23.22	77.85±25.33	<0.001
Stage 1	168 (42.32)	55 (30.22)	<0.001
Stage 2	185 (46.60)	86 (47.25)	
Stage 3	43 (10.83)	36 (19.78)	
Stage 4, 5	1 (0.25)	5 (2.75)	
Cholesterol (mg/dL); mean±SD	206.26±49.89	205.07±51.47	0.764
≤200	213 (48.41)	127 (50.00)	0.686
>200	227 (51.59)	127 (50.00)	
TG (mg/dL); meadian (min, max)	125.5 (32, 1,873)	119 (39, 985)	0.259
≤200	86 (19.55)	39 (15.35)	0.166
>200	354 (80.45)	215 (84.65)	
HDL (mg/dL); mean±SD	41.63±11.03	43.85±12.93	0.017
<40	214 (48.75)	98 (38.74)	0.011
≥40	225 (51.25)	155 (61.26)	
LDL (mg/dL); mean±SD	137.53±44.33	135.15±47.57	0.510
≤130	210 (48.28)	116 (45.85)	0.539
>130	225 (51.72)	137 (54.15)	
Door to balloon time (minutes); meadian (min, max)	39 (8, 773)	57 (8, 1,818)	<0.001
≤90 minutes	433 (81.70)	209 (70.61)	<0.001
>90 minutes	97 (18.30)	87 (29.39)	
Total delay time (minutes); meadian (min, max)	290 (55, 3,233)	309 (43, 12,580)	0.105
EKG: anterior	302 (55.51)	166 (51.71)	0.278
Vessel disease			
Single vessel	296 (66.97)	154 (64.71)	0.552
Multi vessels	146 (33.03)	84 (35.29)	
TIMI pre PCI			
TIMI=0 or 1	370 (68.01)	246 (76.64)	0.007
TIMI=2 or 3	174 (31.99)	75 (23.36)	
TIMI post PCI			
TIMI=0 or 1	2 (0.37)	13 (4.05)	<0.001
TIMI=2 or 3	542 (99.63)	308 (95.95)	
Pain to balloon time: ≤6 hours	315 (58.55)	147 (47.27)	0.001
DM	388 (73.90)	222 (71.38)	0.427
HT	280 (53.23)	150 (47.32)	0.102
Dyslipidemia	122 (24.11)	92 (30.87)	0.036
Smoking	272 (51.52)	155 (49.21)	0.523
Vessel infarction			
LAD	302 (55.51)	166 (51.71)	0.370
RCA	200 (36.76)	130 (40.50)	
LCX	41 (7.54)	22 (6.85)	
LM	0 (0.0)	1 (0.31)	
SVG	1 (0.18)	1 (0.31)	
LIMA	0 (0.0)	1 (0.31)	
Ejection fraction (%); mean±SD	54.38±12.38	51.11±13.23	0.001
≤40	61 (13.41)	61 (24.02)	<0.001
>40	394 (86.59)	193 (75.98)	

CKD=chronic kidney disease; TG=triglyceride; HDL=high density lipoprotein; LDL=low density lipoprotein; EKG=electrocardiogram; PCI=percutaneous coronary intervention; DM=diabetes; HT=hypertension; LAD=left anterior descending artery; RCA=right coronary artery; LCX=left circumflex artery; LM=left main artery; SVG=saphenous vein graft; LIMA=left internal mammary artery; SD=standard deviation

Table 3. The 30-day mortality, 1-year mortality, 30-day and 1-year readmission of early and late discharged STEMI patients in Killip class I

	Hazard ratio	95% CI	p-value
30-day mortality			
Late discharge	6.79	0.76 to 60.75	0.087
Early discharge	1		
1-year mortality			
Late discharge	2.43	1.25 to 4.71	0.009
Early discharge	1		
	Odds ratio	**95% CI**	**p-value**
30-day readmission			
Late discharge	1.42	0.43 to 4.69	0.566
Early discharge	1		
1-year readmission			
Late discharge	2.13	1.16 to 3.92	0.015
Early discharge	1		

CI=confidence interval

class I in group 1 had lower 1-year readmission than group 2 at 3.6% versus 7.5% (OR 2.13, p=0.015), but no difference in 30-day readmission at 1.1% versus 1.6% (OR 1.42, p=0.56) (Table 3).

Discussion

PPCI is currently highly vital in STEMI patients because it obviously reduces the rates of mortality, disability, and disease complications compared to thrombolytic therapy[1-3]. Because of the large number of patients, there is a space constraint in the coronary care unit, especially in the Southeast Asian countries. Although there is increasing pressure to contain the cost and discharge patients as soon as possible after PPCI, limited data exist regarding the safety of early discharge[4-11].

The present study is the first large cohort study exploring the safety of early discharge in patients with ST elevation myocardial infarction after PPCI in Asia. The present study data show that early discharge in STEMI patients within three days after PPCI is safe in terms of 30-day mortality, 1-year mortality, and readmission compared to late discharge in patients with ST elevation myocardial infarction after PPCI.

The authors believe that the present study has notable strengths. The authors used Killip I to identify low risk STEMI patients and found that early discharge in STEMI patients with Killip class I within three days after PPCI is safe in terms of 30-day mortality, 1-year mortality, and readmission.

According to the current ESC STEMI 2017 guidelines, early discharge is safe in low-risk patients, however, the safety data of early discharge in STEMI patients is limited[4-11]. Several studies have prospectively evaluated safety of early discharge. Grines et al[6] in the PAMI-II trial (1993 to 1995), randomized 462 low-risk AMI patients younger than 70 years with left ventricular ejection fraction greater than 45%, one or two vessel disease, successful coronary intervention, and no persistent arrhythmias, treated with PPCI and randomized them to early discharge group during third admission day, or late discharge group. In comparison to the late discharge group, the early discharge group had a similar rate of in-hospital and 6-month adverse events, with a shorter mean hospital stay at 4.2±2.3 versus 7.1±4.7 days (p=0.0001) and this was also associated with lower costs at USD 9,658±5,287 versus 11,604±6,125 (p=0.002). Bogaty et al[14] randomized 120 low-risk AMI patients to a discharge on day 3 versus a standard stay. Short-stay patients had 25% fewer cardiovascular procedures with similar adverse event and rehospitalization rates at six months. Noman et al[10] analyzed retrospective data on 2,448 STEMI patients treated with PPCI and suggested that an early discharge group, within 48 hours, in low-risk patient, is safe with a 4.3% mortality after a mean follow-up of 584 days. The present study data are consistent with these clinical trials and confirms the safety of early discharge within three days of admission in low-risk patients, including only in Killip class I patients, and disagree with any mortality or readmission benefit from keeping low risk patients in hospital longer than three days. Moreover, most of the trials were conducted in quite different health care systems such as USA, Canada, and Europe, while the present study is the first conducted in Asia.

Jones et al[11] reported over 2,700 patients also demonstrated the safety and feasibility of early, within 48 hours, discharge after PPCI. There was no difference in readmission rates in the first 30 days and no all-cause mortality difference in the early discharge group. However, it was argued that such a short inpatient stay might restrict the opportunities for the initiation of secondary prevention treatments and the delivery of education and lifestyle counselling and suggested that shorter hospital stays may be associated with higher readmission rates at 30 days[15]. The present study data supports Jones et al. The authors found that there was no difference in 1-year and 30-day readmission rate between both groups.

Length of stay (LOS) has been associated with

the development of certain complications, particularly nosocomial infections, resulting in an increase in the LOS and health care costs[16]. To this respect, early discharge within three days of admission could offer a potential advantage.

Although, the authors did not perform a cost-effectiveness and nosocomial complications analysis, it is reasonable to assume that an early discharge in STEMI patients within three days after PPCI would lead to lower health care costs and reduced risk for nosocomial complications.

The strength of the present study is that it is reflective of contemporary practice, and the primary outcomes measure were the hard endpoint of mortality and readmission. However, there were several limitations to the present study. Firstly, not all patients fulfilled the inclusion criteria could be enrolled, due to lost data about duration of discharge when the patients were referred to their hospitals. However, this could not bias the present study results because there were only a few patients referred to their hospitals. The second limitation is lack of power to detect small differences in the 30-day mortality and 30-day readmission due to low event rates. The third limitation is that patient characteristics are quite heterogenous in the present study data, but the authors did subgroup analysis to reduce this bias. As with all retrospective and observational studies, it is not possible to account for all confounders.

Conclusion

Early discharge in STEMI patients within three days after PPCI is safe in terms of mortality and readmission compared to late discharge patients, especially in STEMI patients with Killip class I. Early discharge can provide more space for coronary care.

What is already known on this topic?

The current ESC STEMI 2017 guideline recommended that early discharge in low-risk STEMI patient is safe, however, the safety data of early discharge in STEMI patients is limited, especially in Asian countries.

What this study adds?

Early discharge in Thai STEMI patients within three days after PPCI is safe in terms of mortality and readmission compared to the late discharge patients, especially in STEMI patients with Killip class I.

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Conflict of interests

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References

1. Keeley EC, Boura JA, Grines CL. Primary angioplasty versus intravenous thrombolytic therapy for acute myocardial infarction: a quantitative review of 23 randomised trials. Lancet 2003;361:13-20.
2. Steg PG, James SK, Atar D, Badano LP, Blömstrom-Lundqvist C, Borger MA, et al. ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. Eur Heart J 2012;33:2569-619.
3. Kushner FG, Hand M, Smith SC Jr, King SB 3rd, Anderson JL, Antman EM, et al. 2009 focused updates: ACC/AHA guidelines for the management of patients with ST-elevation myocardial infarction (updating the 2004 guideline and 2007 focused update) and ACC/AHA/SCAI guidelines on percutaneous coronary intervention (updating the 2005 guideline and 2007 focused update) a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2009;54:2205-41.
4. Spencer FA, Lessard D, Gore JM, Yarzebski J, Goldberg RJ. Declining length of hospital stay for acute myocardial infarction and postdischarge outcomes: a community-wide perspective. Arch Intern Med 2004;164:733-40.
5. Berger AK, Duval S, Jacobs DR Jr, Barber C, Vazquez G, Lee S, et al. Relation of length of hospital stay in acute myocardial infarction to postdischarge mortality. Am J Cardiol 2008;101:428-34.
6. Grines CL, Marsalese DL, Brodie B, Griffin J, Donohue B, Costantini CR, et al. Safety and cost-effectiveness of early discharge after primary angioplasty in low risk patients with acute myocardial infarction. PAMI-II Investigators. Primary Angioplasty in Myocardial Infarction. J Am Coll Cardiol 1998;31:967-72.
7. De Luca G, Suryapranata H, van 't Hof AW, de Boer MJ, Hoorntje JC, Dambrink JH, et al. Prognostic assessment of patients with acute myocardial infarction

treated with primary angioplasty: implications for early discharge. Circulation 2004;109:2737-43.
8. Azzalini L, Solé E, Sans J, Vila M, Durán A, Gil-Alonso D, et al. Feasibility and safety of an early discharge strategy after low-risk acute myocardial infarction treated with primary percutaneous coronary intervention: the EDAMI pilot trial. Cardiology 2015;130:120-9.
9. Melberg T, Jørgensen M, Ørn S, Solli T, Edland U, Dickstein K. Safety and health status following early discharge in patients with acute myocardial infarction treated with primary PCI: a randomized trial. Eur J Prev Cardiol 2015;22:1427-34.
10. Noman A, Zaman AG, Schechter C, Balasubramaniam K, Das R. Early discharge after primary percutaneous coronary intervention for ST-elevation myocardial infarction. Eur Heart J Acute Cardiovasc Care 2013;2:262-9.
11. Jones DA, Rathod KS, Howard JP, Gallagher S, Antoniou S, De Palma R, et al. Safety and feasibility of hospital discharge 2 days following primary percutaneous intervention for ST-segment elevation myocardial infarction. Heart 2012;98:1722-7.
12. Topol EJ, Burek K, O'Neill WW, Kewman DG, Kander NH, Shea MJ, et al. A randomized controlled trial of hospital discharge three days after myocardial infarction in the era of reperfusion. N Engl J Med 1988;318:1083-8.
13. Newby LK, Eisenstein EL, Califf RM, Thompson TD, Nelson CL, Peterson ED, et al. Cost effectiveness of early discharge after uncomplicated acute myocardial infarction. N Engl J Med 2000;342:749-55.
14. Bogaty P, Dumont S, O'Hara GE, Boyer L, Auclair L, Jobin J, et al. Randomized trial of a noninvasive strategy to reduce hospital stay for patients with low-risk myocardial infarction. J Am Coll Cardiol 2001;37:1289-96.
15. Kociol RD, Lopes RD, Clare R, Thomas L, Mehta RH, Kaul P, et al. International variation in and factors associated with hospital readmission after myocardial infarction. JAMA 2012;307:66-74.
16. Zhan C, Miller MR. Excess length of stay, charges, and mortality attributable to medical injuries during hospitalization. JAMA 2003;290:1868-74.