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Original article

Re-hospitalization following primary percutaneous coronary intervention in patients with ST-elevation myocardial infarction

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Background: Re-hospitalizations (RHs) after primary percutaneous coronary intervention (primary PCI) in ST-elevated myocardial infarction (STEMI) are not well studied in Thailand. We studied the frequency, causes, and factors that might affect unplanned re-hospitalizations which may be helpful to predict and lead to better effective preventions.
Objectives: We aimed to investigate the frequency, causes, and factors that might affect unplanned re-hospitalizations
Methods: We collected data from the Cardiac Center, King Chulalongkorn Memorial Hospital (KCMH) that included all patients with STEMI who underwent primary PCI and followed them for 1 year after the intervention. Unpaired *t* - tests, Chi-squared tests, Fischer's exact tests were utilized for data analysis with Kaplan-Meier curves regarding their first re-hospitalizations.
Results: The study included 96 patients with 15 unplanned RHs patients, 10 (11.36%) patients with unplanned non-cardiac RHs and 5 (5.68%) patients with unplanned cardiac RHs. Only triglyceride levels were significantly different between patients with unplanned cardiac RHs and patients without unplanned RHs.
Conclusion: Among the patients with STEMI that underwent primary PCI and followed-up at KCMH, non-cardiac unplanned RHs occurred in 11.36% with various causes. While cardiac unplanned RHs occurred in 5.86% with non ST-elevated myocardial infarction (NSTEMI) as a leading cause.

Keywords: Myocardial infarction, percutaneous coronary intervention, re-hospitalization.

Myocardial infarction is one of the leading causes of death in Thailand and tend to be increasing every year[1], due to lifestyle changess and an aging society. According to ECS guidelines 2017[2], the treatment of choice for patients with ST-elevated myocardial infarction (STEMI) is primary percutaneous coronary intervention (primary PCI). However, primary PCI in Thailand has some limitations, not only capable hospitals but also referral systems.

Studies about follow-ups after primary PCI in patients with STEMI have been done in many countries[3] but not yet in Thailand. The follow-ups in those studies define re-hospitalizations (RHs) after intervention including cardiac and non-cardiac causes. The results might help plan which treatment is the most appropriate for patients with STEMI in Thailand.

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Methods

Study design and population

We performed a retrospective descriptive study. The data from the Cardiac Center, King Chulalongkorn Memorial Hospital (KCMH) from 1st January 2015 to 31st October 2016 were obtained.

Patients were eligible if they were aged 18 years or above with symptom onset within 24 hours, electrocardiographic criteria for STEMI, and angiographic evidence of at least 1 lesion within the infarct vessel. There were no limits regarding the number of treated lesions. The patients must not have comorbid conditions with life expectancies of less than 1 year, pregnancy, death in the first admission and were not referred for further management from another hospital.

Procedures and data collection

After collecting and selecting data from the cardiac center, all patients were treated with primary PCI according to KCMH standard. We followed each patient for 1 year after intervention using the KCMH database and collected all admission data by 2 collectors independently. Data were composed of two parts. Firstly, first admission details including demographic data (age, sex, race, underlying diseases and past medical history), sign and symptoms (heart rate, blood pressure and body mass index (BMI), laboratory investigations (serum creatinine, fasting blood glucose, hemoglobin A_{1C}, lipid profile, CPK level, CK-MB level, troponin-I level), diagnosis and intervention details; and secondly, re-hospitalization details including cause and number of re-hospitalizations within one year after the procedure was done. In case of more than one diagnosis, we recorded the diagnosis which brought patients to hospital as cause of RHs.

Study end point

Re-hospitalizations (RHs) were defined as readmission in KCMH including both planned and unplanned admissions. Planned RHs were defined as scheduled readmission after the first visit which were recorded as the no RHs group. Unplanned RHs were defined as an unscheduled readmission and cardiac unplanned RHs were defined as unscheduled readmission from a cardiac cause. In cases of patients with planned RHs followed by unplanned RHs, these patents were recorded as unplanned RHs. All RHs causes are described in Table 1.

Primary end points were incidences and causes of unplanned cardiac and non-cardiac RHs. Secondary end points were factors that might predict unplanned cardiac RHs.

Statistical analysis

As for continuous variables, we used means and unpaired *t* - tests. Regarding the categorical data, we used frequency, percentage, Chi-squared tests and Fischer's exact tests. The level of significance was set at 0.05. Data were analyzed using IBM-SPSS statistics version 22. We performed Kaplan-Meier curves for first RHs after intervention in both unplanned cardiac RHs and unplanned non-cardiac RHs.

We compared all parameters from Table 2, 3, 4, and 5 in the no RHs group to the unplanned cardiac and unplanned non-cardiac RHs group to investigate which parameter might be used to predict unplanned cardiac RHs.

Results

There were 304 patients with STEMI admitted at the Cardiac Center, KCMH from 1st January 2015 and 31st October 2016. Two-hundred and eight patients were referred to other hospitals after discharge; only 96 patients were included to our study. Eight patients died during the first admission. Drug-eluting stent was the most common type of stent (85.23%) used in the procedure. After the intervention was done, there were 15 unplanned RHs patients, 10 (11.36%) patients with unplanned non-cardiac RHs and 5 (5.68%) patients with unplanned cardiac RHs as shown in Table 1 and

Table 1. Causes of unplanned re-hospitalization.

Unplanned cardiac re-hospitalization	**No. of RHs (% of RHs)**
Acute ST- elevated myocardial infarction	1 (20%)
Unstable angina	1 (20%)
Non ST - elevated myocardial infarction	2 (40%)
Heart failure	1 (20%)
Total	5 (100%)
Unplanned non-cardiac re-hospitalization	**No. of RHs (% of RHs)**
Cellulitis	1(10%)
Skin rash	1(10%)
Vascular claudication	1(10%)
Liver abscess with *K. pneuminiae* septicemia	1(10%)
Syringomyelia	1(10%)
Simple hyperglycemia	1(10%)
Tracheobronchitis	1(10%)
Acute cholangitis with septic shock	1(10%)
Embolic ischemic stroke	1(10%)
Total	10 (100%)

Table 2. Baseline characteristics (First admission only).

	Overall (n = 88)	**No unplanned RHs (n = 73)**	**Unplanned cardiac RHs (n = 5)**	**Unplanned non-cardiac RHs (n = 10)**	***P*- value cardiac vs no RHs**	***P*-value non-cardiac vs no RHs**
Age (years)	59.49 ± 11.62	57.73 ± 10.13	62.4 ± 7.16	70.9 ± 16.99	0.228	0.038
Male	66 (75%)	60 (82.19%)	4 (80%)	2 (20%)	1	0.002
Hert rates (beats/minute)	78.27 ± 19.57	77.27 ± 17.81	91.00 ± 36.47	79.2 ± 21.81	0.449	0.794
Systolic blood pressure (mmHg)	119.02 ± 23.82	119.27 ± 22.54	116.80 ± 27.04	118.30 ± 33.04	0.85	0.93
Diastolic blood pressure (mmHg)	71.67 ± 15.99	72.45 ± 16.42	68.00 ± 8.37	67.80 ± 15.89	0.328	0.405
Serum creatinine (mg/dL)	1.06 ± 0.5 (n = 87)	1.037 ± 0.46 (n = 72)	1.50 ± 1.02	1.016 ± 0.33	0.364	0.863
Fasting plasma glucose (mg/dL)	145.32 ± 57.73 (n = 84)	141.91 ± 55.32 (n = 71)	133.50 ± 59.91 (n = 4)	177.44 ± 71.55 (n = 9)	0.8	0.184
HbA_{IC} (%)	6.79 ± 1.95 (n = 84)	6.57 ± 1.77 (n = 71)	6.94 ± 1.38	8.69 ± 2.85 (n = 8)	0.597	0.076
Total cholesterol (mg/dL)	198.27 ± 52.17 (n = 87)	199.53 ± 49.52	212.6 ± 91.70	180.11 ± 49.62 (n = 9)	0.768	0.294
Triglyceride (mg/dL)	149.21 ± 109.88 (n = 87)	151.97 ± 117.18	116.80 ± 17.51	144.78 ± 72.91 (n = 9)	0.031	0.8
HDL cholesterol (mg/dL)	39.93 ± 11.43 (n = 87)	39.26 ± 10.95	46.00 ± 11.27	42.00 ± 15.16 (n= 9)	0.257	0.612
LDL cholesterol (mg/dL)	135.11 ± 50.29 (n = 87)	135.97 ± 45.96	164.40 ± 99.69	111.89 ± 45.35 (n= 9)	0.56	0.164
Creatine kinase (U/L)	1865.08 ± 1920.24 (n = 84)	1878.29 ± 1759.09 (n = 69)	1635.20 ± 1326.64	1887.4 ± 3132.52	0.719	0.993
CK-MB (U/L)	238.78 ± 249.22	247.14 ± 257.18	296.00 ± 239.14	149.20 ± 185.85	0.68	0.16
Admisssion duration (days)	4.72 ± 7.17	3.22 ± 3.47	7.20 ± 4.15	14.50 ± 16.30	0.98	0.057
CCU duration (days)	2.46 ± 2.59	2.23 ± 1.73	2.00 ± 1.22	4.4 ± 5.98	0.706	0.284
Diabetes Mellitus	24 (27.27%)	13 (14.77%)	3 (60%)	8 (80%)	0.058	0
Hypertension	44 (50%)	31 (42.46%)	3 (60%)	10 (100%)	0.648	0
Smoking	30 (34.09%)	29 (39.73%)	1 (20%)	0 (0%)	0.644	0.013
Dyslipidemia	70 (79.54%)	56 (76.71%)	5 (100%)	9 (90%)	0.58	0.683
Previous MI	12 (13.63%)	9 (12.33%)	1 (20%)	2 (20%)	0.506	0.615
Stroke	5 (5.68%)	4 (5.48%)	1 (20%)	0 (0%)	0.289	1
CPR	6 (6.82%)	4 (5.48%)	0 (0%)	2 (20%)	1	0.151

Data are expressed as mean ± SD.

RH: Rehospitalizations; HDL: High density lipoprotein; LDL: Low density lipoprotein; CK-MB: creatine kinase- MB; CCU: Coronary care unit; CPR : Cardioplumonary resuscitation;MI: Myocardial infarction.

2. According to Table 1, NSTEMI was the leading cause of unplanned cardiac RHs (2, 40%) but causes of unplanned non-cardiac RHs were various. According to Table 2, only triglyceride levels were significantly different between patients with unplanned cardiac RHs and patients without unplanned RHs. On the other hand, age, sex and underlying diseases (diabetes, hypertension, smoking) were significantly different between patients with unplanned non-cardiac and patients without unplanned RHs. Other variables such as race, chief complaint and complications during their first visit, and anti-platelets are shown in Table 3, 4 ,5 and 6 respectively. The unrecorded data was also shown in Table 2 as decreased in numbers. There was no death during 1 year after intervention and 20 planned RHs patients were admitted for further management, most of the RHs were cardiac RHs because they had more than 1 vascular lesions. Kaplan-Meier curves showed the incidence rate within one year in both unplanned cardiac and non-cardiac RHs were 5.68% and 11.36, respectively. (Figure 1).

Table 3. Comparisons among races.

		Overall (n = 88)	**No RHs (n = 73)**	**Unplanned cardiac RHs (n = 5)**	**Unplanned non - cardiac RHs (n = 10)**	***P* - value (cardiac vs no RHs)**	***P* - value (non-cardiac vs no RHs)**
Thai	Thai	84, 95.45%	69, 94.52%	5, 100%	10, 100%		
	Indian	1, 1.14%	1, 1.37%	0, 0%	0, 0%		
	South					1	1
Non-Thai	Korean	1 ,1.14%	1, 1.37%	0, 0%	0, 0%		
	Singaporean	1, 1.14%	1, 1.37%	0, 0%	0, 0%		
	Belgium	1, 1.14%	1, 1.37%	0, 0%	0, 0%		

Table 4. Comparisons with chief complaints at first visits.

	Overall (n = 88)	**No RHs (n = 73)**	**Unplanned cardiac RHs (n = 5)**	**Unplanned non-cardiac RHs (n = 10)**	***P* - value (cardiac vs no RHs)**	***P* - value (non-cardiac vs no RHs)**
Chest pain	76, 86.36%	68, 93.15%	3, 60%	5, 50%		
Dyspnea	5, 5.68%	2, 2.74%	1, 20%	2, 20%		
Syncope	3, 3.41%	2, 2.74%	0, 0%	1, 10%	0.045	0.002
Headache	1, 1.14%	1, 1.37%	0, 0%	0, 0%		
Elective*	2, 2.27%	0, 0%	1, 20%	1, 10%		
No clinical**	1, 1.14%	0, 0%	0, 0%	1, 10%		

* Planned admission for coronary angiography with percutaneous coronary intervention
**Found STEMI by preoperative (extend fusion T12 - S1) EKG

Table 5. Comparisons with complications from STEMI during first visits.

Missing = 2	**Overall (n = 86)**	**No RHs (n = 72)**	**Unplanned cardiac RHs (n = 5)**	**Unplanned non-cardiac RHs (n = 9)**	***P* - value (cardiac vs no RHs)**	***P* - value (non-cardiac vs no RHs)**
No complication	69, 80.23%	60, 83.33%	3, 60%	6, 66.67%		
Arrhythmia	3, 3.49%	3, 4.17%	0, 0%	0, 0%		
Syncope	2, 2.33%	1, 1.39%	0, 0%	1, 11.11%	0.282	0.24
Heart failure	9, 10.46%	5, 6.94%	2, 40%	2, 22.22%		
Acute kidney injury	2, 2.33%	2, 2.78%	0, 0%	0, 0%		
Hematoma	1, 1.16%	1, 1.39%	0, 0%	0, 0%		
Death	8, 8.33% (n = 96)	-	-	-	-	-

Table 6. Comparisons of the antiplatelets.

Missing = 3	Overall (n = 85)	No RHs (n = 71)	Unplanned cardiac RHs (n = 5)	Unplanned non-cardiac RHs (n = 9)	*P* - value (cardiac vs no RHs)	*P* - value (non-cardiac vs no RHs)
Aspirin alone	1, 1.18%	1, 1.41%	0, 0%	0, 0%		
Aspirin + Clopidogrel	59, 69.41%	54, 76.06%	3, 60%	2, 22.22%		
Aspirin + Ticagrelor	21, 24.71%	13, 18.31%	2, 40%	6, 66.67%	0.453	0.006
Aspirin + Prasugrel	2, 2.35%	2, 2.82%	0, 0%	0, 0%		
Aspirin + Warfarin	2, 2.35%	1, 1.41%	0, 0%	1, 11.11%		

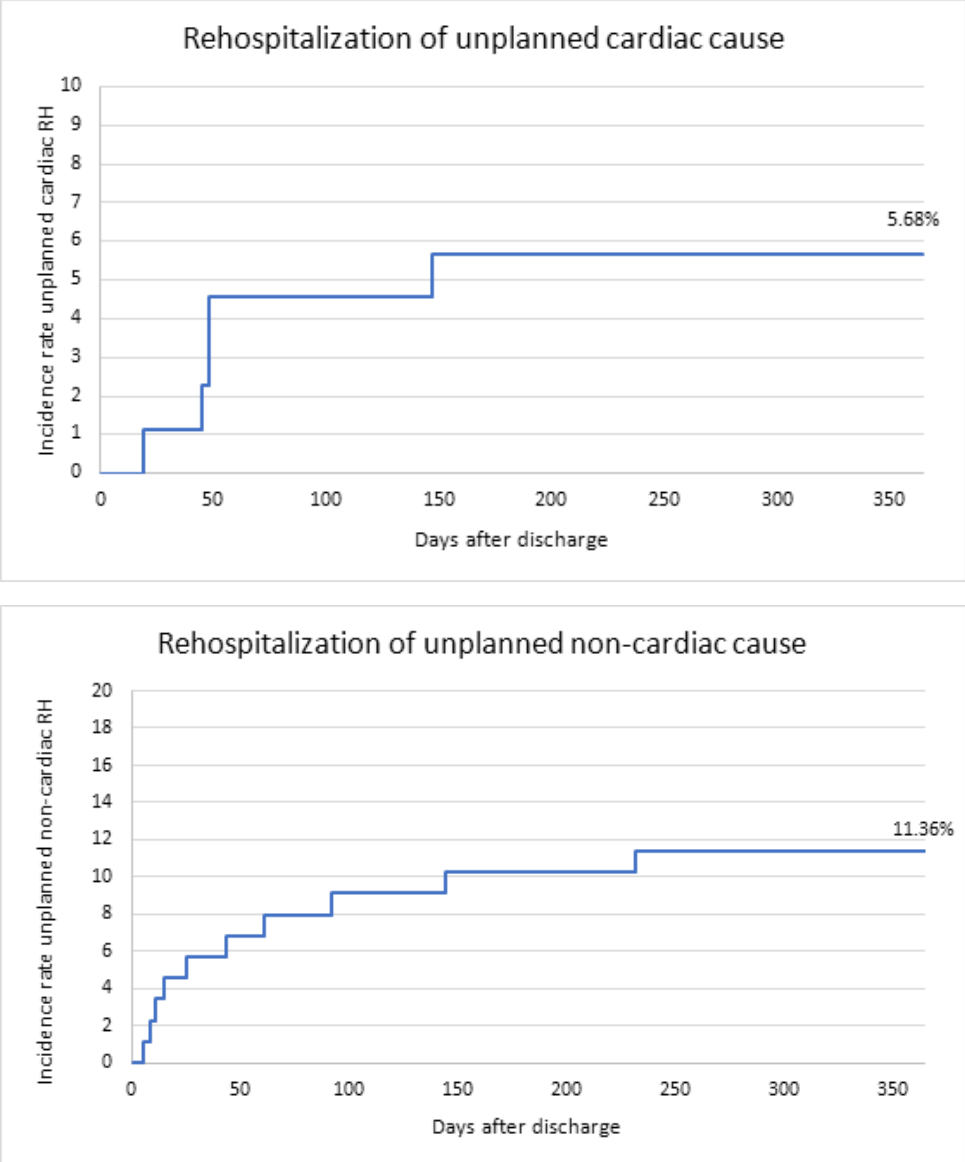

Figure 1. Kaplan-Meier curves showing the incidence rates of unplanned cardiac and noncardiac re-hospitalization within one year.

Unplanned RHs occurred in 15 patients; 5 (5.68%) were cardiac RHs and 10 (11.36%) were non-cardiac RHs. Those with cardiac RHs were aged from 56 to 83 years old and their LDL level ranged from 104 to 271 mg/dL. Three of the five had an impaired left ventricular (LV) systolic function with an estimated left ventricular ejection function (LVEF) of 30%, 33% and 40%; others had normal LV systolic function with an estimated LVEF of 56% and 60%.

Twenty admissions were recorded as planned RHs for further management of which most had more than one culprit lesion.

Discussion

According to Table 5, 9 patients had heart failure before discharge whereas 3 were in the cardiac RHs group (60%). Hence heart failure before discharge might predict RHs.

The result was not correlated with any previous study (Spitzer E, *et al* [3] and Dunlay S, *et al* [5]) which saw unplanned cardiac RHs more predominant (Spitzer E, *et al.* [3]: unplanned cardiac RHs 11.7% and unplanned non-cardiac 6.9% and Dunlay S, *et al* [5]: unplanned cardiac RHs 42.6% and unplanned non-cardiac 30.2%). This might be due to not only the size of the study population that was much smaller than in previous studies[3, 5], but also their follow-up capability, although their age, total cholesterol and LDL levels were similar to our results.[3] Only triglyceride levels were significantly different between patients with unplanned cardiac RHs and patients without RHs which was higher in non-RHs group. However, the independent effect of triglyceride levels to risk of cardiovascular disease was controversy in previous study. [6, 7]

In previous studies[3, 5], independent predictors were LVEF, Syntax scores, diabetes mellitus, chronic obstructive pulmonary disease (COPD), anemia, Killip class, hospital length stay, complication of intervention. However, predictors of unplanned cardiac RHs cannot be assessed due to the limitated of number of patients enrolled in our study. There are some limitations in this study. The number of our participants in the study was low because we did not include referred patient due to the lack of follow-up data in the KCMH database. Therefore, we can not infer to the population. RHs might be missed because patients might be admitted to hospitals other than KCMH. Moreover, some patients had more than one condition which was not only cardiac but also non-cardiac causes for which we used the chief complaint for the recruitment of subjects. In addition, adverse events were not analyzed due to the limited data.

Conclusion

Among patients with STEMI who underwent primary PCI and followed-up at KCMH, non-cardiac unplanned RHs occurred in 11.36% with various causes. While cardiac unplanned RHs occurred in 5.86% with NTEMI as a leading cause. Predictors of unplanned cardiac RHs could not be concluded due to the limitations above.

Conflict of interest

None of the authors has any potential conflict of interest to disclose.

References

1. Yosawatthana P. Coronary artery disease. Anual epidermiological surveillance report 2015. Nonthaburi: Bureau of Epidemiology, Thailand; 2015. p. 216-8.
2. Ibánez B, James S, Agewall S, Antunes MJ, Bucciarelli-Ducci C, Bueno H, et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. Rev Esp Cardiol (Engl Ed) 2017;70:1082.
3. Spitzer E, Frei M, Zaugg S, Hadorn S, Kelbaek H, Ostojic M, et al. Rehospitalizations following primary percutaneous coronary intervention in patients with ST-elevation myocardial infarction: Results from a multi-center randomized trial. J Am Heart Assoc 2017; 6:e005926.
4. Meadows E, Sugihara T, Zagar A, Bae J, Ramaswamy K. PCV118 characterization of commercially insured patients with acute coronary syndrome (ACS) receiving percutaneous coronary intervention (PCI). Value Health 2010;13:A172.
5. Dunlay SM, Weston SA, Killian JM, Bell MR, Jaffe AS, Roger VL. Thirty-day rehospitalizations after acute myocardial infarction: a cohort study. Ann Intern Med 2012;15:11-8.
6. Miller M, Stone NJ, Ballantyne C, Bittner V, Criqui MH, Ginsberg HN, et al. Triglycerides and cardiovascular disease: a scientific statement from the American Heart Association. Circulation 2011;123: 2292-333.
7. Nordestgaard BG, Varbo A. Triglycerides and cardiovascular disease. Lancet 2014; 384:626-35.