Low Use of Statins in Patients with Acute Myocardial Infarction: A Single Center Experience

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Background: Current guidelines recommend that patients with acute myocardial infarction (AMI) should be discharged on statin therapy. However, little data are available regarding the usage of statin in AMI patients in real-world practice. The present study investigated the current status of statin use and the effect of continuous statin treatment on clinical outcomes in patients with AMI.

Methods and Results: Three hundred and twenty-five patients (aged 62 ± 13 years, M/F = 258/67) with AMI were enrolled. The administration of statin therapy was at the discretion of the treating physician. Patients were classified into 2 groups: patients receiving continuous statin therapy, defined as at least 85% of statin intake throughout the whole study period (adherent group, n = 167, 51%) and patients not taking continuous statin therapy (nonadherent group, n = 158, 49%). Continuous statin therapy was independently associated with a reduction in the risk of adverse clinical outcomes (38% versus 68%; $P < 0.0001$). By Cox proportional hazard analyses, the adjusted odds ratio for the development of adverse events in the adherent group compared with the nonadherent group was 0.56 (95% CI, 0.32 to 0.97, $P = 0.039$).

Conclusion: Continuous statin therapy may reduce the risk of adverse clinical outcomes after AMI. However, the relatively low use of statin in the study patients indicates that there remains substantial room to improve implementation of statin therapy to AMI patients in real-world practice.

Key Words: Statins • Acute myocardial infarction • Prognosis

INTRODUCTION

Most recent studies have reported that patients with acute coronary syndrome who were taking a statin when they were discharged had lower rates of death and ischemic events in the ensuing months than patients who were not.[1-7] Starting statin therapy before hospital discharge would also strongly encourage long-term compliance.[8,9] Furthermore, statin therapy has demonstrated a favorable safety profile and is rarely associated with adverse effects.[10]

Therefore, current guidelines from the American College of Cardiology and the American Heart Association (ACC/AHA) recommend that patients with unstable angina, non-ST-segment elevation myocardial infarction (NSTEMI) or ST-elevation myocardial infarction (STEMI) should be discharged on statin therapy.[11-14] Some authors went even further and suggested recommending early use of high-dose statins to achieve low-density lipoprotein cholesterol (LDL-C) concentrations substantially below current target levels for all patients with acute coronary syndrome, regardless of what their LDL-C levels may be,

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as the standard of care.[7,15,16] However, little data are available regarding the use of statins in patients with acute myocardial infarction (AMI) in real-world practice in Taiwan. The purpose of the present study was to investigate the current use of statins in AMI patients and the influence of statin therapy on their clinical outcomes.

METHODS

Patient populations

A retrospective cohort study of 325 patients (258 men and 67 women, aged 62 ± 13 years), selected from a total of 374 consecutive patients with AMI admitted to the Division of Cardiology at Cheng-Hsin Rehabilitaiton Medical Center between January 2002 and December 2005, was performed. Those 49 patients who were lost to follow-up were considered to be ineligible for the study. A diagnosis of AMI was made if there were new pathological Q waves or new persistent ST-segment or T-wave changes in conjunction with elevated levels of a total serum creatine kinase $\geq$ 2 times the upper limit of normal with presence of muscle-brain (MB) isoenzyme of creatine kinase higher than the upper limit of normal, and positivity for cardiac troponin I. Patients who presented with cardiogenic shock were excluded from the analysis.

The administration of statin therapy in this study was at the discretion of the treating physician. Patients were classified into two groups: patients receiving continuous statin therapy from the index hospitalization throughout the whole study period (adherent group, n = 167) and patients not receiving continuous statin therapy (nonadherent group, n = 158). The compliance of statin therapy was assessed through chart review and telephone contacts. The quantity dispensed and the numbers of days supplied from each filled prescription were used to calculate the proportion of days on which a patient had a statin available in each interval. Patients with continuous statin therapy or adherent individuals were defined as those with a proportion of days covered by statin of at least 85% in a given interval. Commercially available statins screened for in this study included fluvastatin, simvastatin, atorvastatin, lovastatin, and pravastatin.

Data collection

The demographics, preadmission risk factors, procedural data, medication use, hemodynamic status, equipment use and final results of each case were recorded in a database. Clinical event data during the index hospitalization and during the follow-up period were collected by cardiology nurses and research coordinators through patient interview, chart review and serial telephone contacts. Major adverse clinical events were defined as in-hospital mortality and mortality and non-fatal cardiovascular events after discharge, including recurrent non-fatal AMI, stroke, or requirement for re-hospitalization for worsening heart failure, revascularization procedures, including elective percutaneous coronary interventions (PCI) and elective coronary artery bypass graft surgery (CABG). Since emergency PCI and emergency CABG are necessary procedures in the acute treatment of AMI patients during the index hospitalization, they were not considered major adverse clinical events.

Statistical analysis

Patient demographics, risk factors, procedural data, medications, hemodynamic status, and laboratory data were compared between groups by univariate analyses with appropriate tests, depending on the level and distribution of measurements. Continuous variables were expressed as mean ± SD and were compared by Student's *t* test or Mann-Whitney U test. Categorical data were displayed as frequencies and percentages. Chi-square test was used for bivariate analysis for categorical data. When the cell number is small, Fisher's exact test was used.

Logistic-regression analyses were performed to determine the possible influencing factors on the continuous statin therapy: age, gender, previous hyperlipidemia, baseline LDL-cholesterol levels, the time between onset of symptoms to hospital, left ventricular failure, presence of 2- or 3-vessel diseases, and need for emergency PCI or CABG.

Kaplan-Meier estimation and Cox proportional hazards modeling were used respectively for unadjusted and adjusted survival analysis. Kaplan-Meier analyses of cumulative event-free rates were done with the AMI patients being stratified into two groups according to whether continuous statin therapy was administered. The differences between event-free curves were tested by a log rank test. In multivariable Cox proportional hazards analyses, the association between the continuous use of

statin therapy and clinical outcomes was examined. The models were adjusted for variables that were considered to reflect severity of coronary artery disease and AMI at baseline and that were associated with adverse clinical events, including age, gender, risk factors, baseline LDL-cholesterol levels, the time between onset of symptoms to hospital, left ventricular failure, anterior wall infarction, presence of 2- or 3-vessel diseases, need for emergency PCI or CABG, and concomitant medications. Data are reported as the estimated hazard ratios and 95% confidence intervals.

All statistical analyses were performed using SAS statistical software (SAS Institute). All values are 2 tailed, and a P value < 0.05 was considered statistically significant.

RESULTS

Basic characteristics

Patient demographics, risk factors, and other clinical parameters are presented in Table 1. There were more

Table 1. Demographic variables, risk factors, and other parameters in acute myocardial infarction patients receiving continuous statin therapy (Adherent group) and patients not receiving continuous statin therapy (Non-adherent group)

	Adherent group (n = 167)	Nonadherent group (n = 158)	P value
Age, years	58 ± 12	66 ± 12	< 0.0001
Male, n (%)	139 (83%)	119 (75%)	0.099
Risk factors			
Current smoker, n (%)	101 (61%)	86 (54%)	0.354
Hypertension, n (%)	82 (49%)	88 (56%)	0.267
Diabetes mellitus, n (%)	47 (28%)	56 (36%)	0.189
Hyperlipidemia, n (%)	67 (40%)	28 (18%)	< 0.0001
Onset to hospital > 12 hours, n (%)	71 (43%)	84 (53%)	0.075
Anterior wall infarction, n (%)	97 (58%)	85 (54%)	0.076
ST-elevation AMI, n (%)	129 (78%)	112 (71%)	0.164
Heart failure (Killip II or III), n (%)	54 (33%)	60 (39%)	0.060
Hemodynamic data			
Systolic blood pressure, mmHg	133 ± 29	136 ± 26	0.396
Diastolic blood pressure, mmHg	80 ± 17	80 ± 21	0.750
Heart rates, bpm	80 ± 15	81 ± 20	0.532
Procedural data			
2 or 3-vessel CAD, n (%)	95 (59%)	104 (72%)	0.012
Emergency PCI, n (%)	146 (87%)	91 (56%)	< 0.0001
Stenting, n (%)	76 (46%)	51 (32%)	0.017
Thrombolysis, n (%)	18 (11%)	14 (9%)	0.582
Emergency CABG, n (%)	3 (2%)	28 (18%)	< 0.0001
Medications			
GP IIb/IIIa blockers, n (%)	58 (35%)	38 (24%)	0.039
Anti-platelets, n (%)	152 (91%)	120 (76.4%)	0.0003
ACEI/ARB, n (%)	118 (71%)	73 (46.2%)	< 0.0001
Beta-blockers, n (%)	114 (68%)	72 (46%)	< 0.0001
Laboratory data			
White count, cells/cumm	10356 ± 3338	10193 ± 3360	0.663
hsCRP, mg/dL	2.1 ± 4.2	2.9 ± 5.1	0.225
Peak creatine kinase, IU/L	2277 ± 1882	1847 ± 1664	0.051
Total cholesterol, mg/dL	201 ± 40	174 ± 37	< 0.0001
LDL-cholesterol, mg/dL	132 ± 38	109 ± 32	< 0.0001
HDL-cholesterol, mg/dL	44 ± 11	42 ± 12	0.364
Triglycerides, mg/dL	158 ± 133	144 ± 133	0.365

AMI = acute myocardial infarction; CAD = coronary artery disease; PCI = percutaneous coronary interventions; CABG = coronary artery bypass grafting; GP IIb/IIIa blockers = glycoprotein IIb/IIIa blockers; ACEI/ARB = angiotensin- converting enzyme inhibitors or angiotensin II receptor blockers; hsCRP = high-sensitivity C-reactive protein; LDL-cholesterol = low density lipoprotein cholesterol; HDL-cholesterol = high density lipoprotein cholesterol.

men than women in this study population. The patients receiving continuous statin therapy were younger than those who were not ($P < 0.0001$). As expected, the prevalence of hyperlipidemia was significantly greater and the serum levels of total cholesterol and LDL-C on admission were significantly higher in patients receiving continuous statin therapy compared with patients not taking continuous statins ($P < 0.0001$, $P < 0.0001$, and $P < 0.0001$, respectively). However, no significant differences in the prevalence of smoking, hypertension, or diabetes mellitus were detected between the two groups.

In the present study, although the two groups did not significantly differ with respect to their incidences of anterior wall AMI, STEMI, peak creatine kinase levels, the time between the onset of symptoms and the arrival at emergency department, clinically overt heart failure (Killip II or III), and hemodynamic parameters, the incidence of presence of double- or triple-vessel coronary artery disease was significantly greater ($P = 0.012$) and significantly more of them underwent emergency CABG ($P < 0.0001$) in the nonadherent group.

By contrast, significantly more adherent patients receiving continuous statin therapy underwent emergency PCI, including stenting ($P < 0.0001$ and $P = 0.017$ respectively). Patients receiving continuous statin therapy were also more likely to be treated with glycoprotein IIb/IIIa blockers ($P = 0.039$), anti-platelet agents including aspirin, ticlopidine and clopidogrel ($P = 0.0003$), angiotensin-converting enzyme inhibitors or angiotensin receptor blockers ($P < 0.0001$), or beta-blockers ($P < 0.0001$). However, no significant difference in the use of thrombolytic therapy was detected between the two groups.

White count, serum levels of high-sensitivity C-reactive protein, high-density lipoprotein cholesterol and triglyceride were similar in both groups.

Possible influencing factors on the continuous statin therapy

Logistic-regression analyses identified age, previous hyperlipidemia, primary PCI and emergency CABG as independent predictors of which AMI patients would receive continuous statin therapy in the present study (Table 2). That is, younger patients, patients with previous hyperlipidemia, and those who underwent emergency PCI were more likely to receive continuous statin therapy. By contrast, significantly fewer patients underwent emergency CABG received continuous statin therapy.

Prognosis

The major adverse clinical event incidence is presented in Table 3. The median follow-up period was 366 days (93 to 694 days, 25th to 75th percentiles). There was a 53% (172 of 325) overall event rate in the study

Table 2. Predictors of which AMI patients would receive continuous statin therapy in the present study: Logistic-regression analysis

	Odd ratio	95% C.I.	P value
Full model			
Age ≦ 65 years	2.34	1.32-4.17	0.004
Female gender	0.98	0.46-2.08	0.957
Previous hyperlipidemia	2.96	1.58-5.56	0.0007
LDL-cholesterol > 130 mg/dL	0.93	0.52-1.64	0.796
Onset to hospital > 12 hours	1.07	0.56-2.05	0.844
Heart failure (Killip II or III)	1.00	0.57-1.77	0.993
2 or 3-vessel CAD	0.64	0.36-1.13	0.122
Emergency PCI	4.73	2.04-10.93	0.0003
Emergency CABG	0.27	0.07-1.08	0.064
Reduced model			
Age ≦ 65 years	2.56	1.51-4.34	0.0005
Previous hyperlipidemia	2.83	1.52-5.28	0.001
Emergency PCI	4.30	1.98-9.34	0.0002
Emergency CABG	0.23	0.06-0.90	0.035

AMI = acute myocardial infarction; LDL-cholesterol = low density lipoprotein cholesterol; CAD = coronary artery disease; PCI = percutaneous coronary interventions; CABG = coronary artery bypass grafting.

Table 3. Incidence of major adverse clinical events in acute myocardial infarction patients receiving continuous statin therapy (Adherent group) and patients not receiving continuous statin therapy (Non-adherent group) calculated by person-year

	Adherent group (n = 167)	Nonadherent group (n = 158)	P value
Follow-up period, Person-year (%)	254 (100)	141 (100)	
All MACE, n (%)	64 (25.2)	108 (76.6)	< 0.0001
Total mortality, n (%)	3 (1.2)	33 (23.4)	< 0.0001
In-hospital mortality, n (%)	0 (0)	8 (5.7)	< 0.0001
Mortality after discharge, n (%)	3 (1.2)	25 (17.7)	< 0.0001
Non-fatal MACE after discharge, n (%)	61 (24.0)	75 (53.2)	< 0.0001
Recurrent non-fatal AMI	2 (0.8)	1 (0.8)	0.932
Worsening heart failure	5 (2.0)	12 (8.5)	0.006
Elective PCI, n (%)	43 (16.9)	29 (20.6)	0.418
Elective CABG, n (%)	11 (4.3)	33 (23.4)	< 0.0001

MACE = major adverse cardiac event; AMI = acute myocardial infarction; PCI = percutaneous coronary interventions; CABG = coronary artery bypass grafting.

population.

Within the total combined patient population, major adverse clinical events were the primary cause of death in 36. The most common cardiac causes of death were fatal MI (10 cases), intractable heart failure (9 cases), sudden death without premonition of the progression of symptoms, presumed to be due to arrhythmia (4 cases), and cardiac rupture (2 cases). The most common non-cardiac causes of death were cancer (4 cases), stroke (3 cases), sepsis (2 cases), and multiple organ failure (2 cases). Univariate analysis of the incidence rates by person-year calculation revealed that the overall event rate (25.2% versus 76.6%, $P < 0.0001$), the incidence of total mortality (1.2% versus 23.4%, $P < 0.0001$), in-hospital mortality (0% versus 5.7%, $P < 0.0001$), cardiac death (0.8% versus 16.3%, $P < 0.0001$) and non-cardiac death (0.4% versus 7.1%, $P = 0.006$) were all significantly lower in the adherent group compared with the nonadherent group (Table 3).

During follow-up, three of the 325 patients were re-hospitalized for non-fatal recurrent AMI and 17 of them for worsening heart failure. One hundred and sixteen of them were readmitted for revascularization procedures, of which 72 underwent elective repeat PCI or PCI for a new lesion, and 44 underwent elective CABG. By person-year calculation, no significant differences between groups were observed with respect to the incidence of non-fatal recurrent AMI or readmission for elective PCI. However, the incidences of readmission for worsening heart failure and elective CABG were significantly lower in the adherent group compared with the nonadherent group (2.0% versus 8.5%, $P = 0.006$ and 4.3% versus 23.4%, $P < 0.0001$, respectively).

Kaplan-Meier analyses of cumulative event-free rates, calculated by person-year, were further performed with the AMI patients being stratified into two groups on the basis of whether continuous statin therapy was administered in Figure 1. The difference in event-free survival curves between the two groups was significant, with respect to mortality (Figure 1A) and all major adverse clinical events (Figure 1B) ($P = 0.0009$ and $P = 0.0021$, respectively, by log rank test).

In multivariable Cox proportional hazards analyses, the association between continuous statin use and clinical outcomes was examined. After adjustment for the possible adverse baseline variables (age, gender, risk factors, and the time between onset of symptoms to hospital) and markers of severity of infarction (left ventricular failure, anterior wall infarction, presence of 2- or 3-vessel diseases, need for emergency CABG), procedural data and concomitant medications, continuous statin therapy was still independently associated with a significant reduction in the risk of adverse clinical events (hazard ratio [HR] 0.56, 95% CI 0.32 to 0.97, $P = 0.039$) (Table 4). In this model, male gender (HR 0.48, 95% CI 0.29 to 0.81, $P = 0.006$), presence of heart failure on admission (HR 1.61, 95% CI 1.03 to 2.53, $P = 0.037$) and need for emergency CABG during the index hospitalization (HR 32,1, 95% CI 11.4 to 89.8, $P < 0.0001$) were also significantly related to clinical outcomes. There was

Table 4. Predictors of major adverse clinical events during follow-up: multivariate Cox proportional hazard analysis

	Hazard ratio	95% C.I.	P value
Continuous statin therapy	0.56	0.32-0.97	0.039
Age > 61 years	1.00	0.98-1.02	0.871
Male gender	0.48	0.29-0.81	0.006
Smoking	1.28	0.79-2.06	0.210
Hypertension	1.29	0.83-2.02	0.263
Diabetes mellitus	1.13	0.70-1.82	0.614
Hyperlipidemia	1.58	0.94-2.65	0.086
LDL-cholesterol > 130 mg/dL	0.97	0.57-1.65	0.908
Onset to hospital > 12 hours	0.89	0.56-1.40	0.610
Anterior wall infarction	1.26	0.80-1.99	0.323
Heart failure (Killip II or III)	1.61	1.03-2.53	0.037
2 or 3-vessel CAD	1.06	0.63-1.78	0.828
Emergency PCI	0.79	0.42-1.47	0.454
Emergency CABG	32.1	11.4-89.8	< 0.0001
Use of GP IIb/IIIa blockers	1.09	0.66-1.80	0.727
Use of anti-platelets	1.11	0.60-2.08	0.734
Use of ACEI/ARB	0.77	0.47-1.26	0.299
Use of beta-blockers	0.72	0.42-1.21	0.210

LDL-cholesterol = low density lipoprotein cholesterol; CAD = coronary artery disease; PCI = percutaneous coronary interventions; CABG = coronary artery bypass grafting; GP IIb/IIIa blockers = glycoprotein IIb/IIIa blockers; ACEI/ARB = angiotensin-converting enzyme inhibitors or angiotensin II receptor blockers.

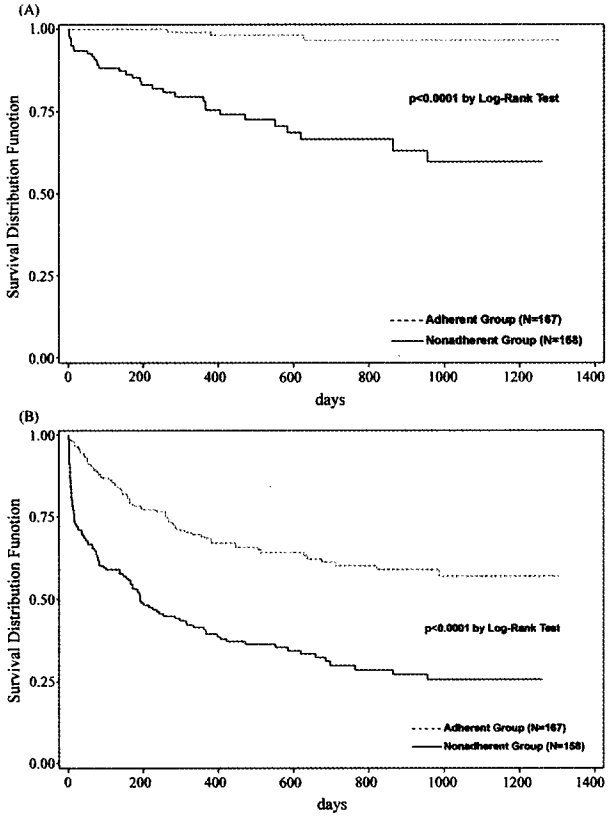

Figure 1. *Kaplan-Meier estimates of survival according statin therapy in patients with acute myocardial infarction, expressed by person-year calculation: (A) mortality, (B) all major adverse clinical events.*

no independent association between age, smoking, hypertension, diabetes mellitus, hyperlipidemia, LDL-C level, the time between onset of symptoms to hospital, location of AMI, presence of double- or triple-vessel coronary artery disease, PCI, thrombolysis, use of glycoprotein IIb/IIIa blockers, anti-platelets, angiotensin-converting enzyme inhibitors or angiotensin II receptor blockers, or beta-blockers and clinical outcomes in multivariable analyses.

DISCUSSION

Our data demonstrated that patients receiving continuous statin therapy after AMI had lower rates of death and readmission for worsening heart failure or elective CABG than patients not taking continuous statins, even after adjusting for patient demographics, risk factors, medications, and variables that were considered to reflect severity of AMI at baseline and that were associated with adverse outcomes. Furthermore, although the current guidelines for prescribing LDL-C lowering agent for all patient recovery from AMI have been endorsed by most clinicians, and the guidelines have become a quality benchmark for managing AMI patients, the present

study revealed that the use of statins in AMI patients fell short of the guideline recommendation.

It is well known that acute coronary syndromes are caused by rupture or superficial erosion on atherosclerotic plaque, with subsequent platelet deposition and thrombosis. Vulnerable plaques demonstrate characteristic features – they have relatively high inflammatory cell contents with increased lipid cores, and demonstrate matrix degradation, smooth muscle cell death and reduced collagen content.[17,18] Reversal of this vulnerable phenotype is now a major goal in acute coronary syndrome treatment.[17,18] In addition to lowering lipids, recent studies have demonstrated that statins possess anti-inflammatory and anti-thrombotic properties, and a combination of these effects may contribute to their clinical beneficial effects.[19] Since the risk of cardiovascular death is highest within the first few months after acute coronary syndrome, early statin treatment may result in a wide variety of benefits, including reduced lesion progression and increased regression, improved endothelial function, and reduced cardiovascular events.[1-7,20]

Recent trials have also demonstrated that intensive statin therapy is superior to moderate therapy for reducing morbidity following an acute coronary syndrome event and for slowing the progression of coronary atherosclerosis.[7-9] Starting statin therapy before hospital discharge would also strongly encourage long-term compliance.[8,9] Further, statin therapy is safe and rarely associated with adverse effects.[10] Therefore, current ACC/AHA guidelines call for lipid-lowering therapy after hospital discharge for patients with unstable angina or NSTEMI whose LDL-C values at discharge are at 130 mg/dL or higher and for those whose LDL-C level is greater than 100 mg/dL after diet.[11-13] For patients recovering from STEMI with LDL-C level greater than 100 mg/dL, the revised guidelines from the ACC/AHA proposed in 2004 went even further and recommended that they should be discharged on statin therapy with the goal of reducing the LDL-C level to less than 70 mg/dL. Furthermore, it is also reasonable to prescribe statin therapy to patients recovering from STEMI whose LDL-C level is either unknown or is less than 100 mg/dL.[14]

In the present study, 167 of the 325 (51%) AMI patients received continuous statin treatment from the index hospitalization throughout the follow-up period. Whilst this result is not so bad as compared to a recent review of recent clinical trials,[21,22] up to one half of infarct survivors are still inadequately treated with statins. That is, we still fall far short of achieving guidelines established to manage dyslipidemia and vascular risk, indicating that the dissemination of clinical guidelines has not been accompanied by desired improvements in guideline adherence. As we known, without effective implementation, guidelines will have little effect on patient outcomes. The most common barriers to guideline implementation include lack of awareness, inertia of previous practice, lack of agreement, and external barriers, including lack of time or staff support.[23,24] These important barriers to implementing statin therapy, the identification of appropriate candidates for intervention and the ability and willingness to devote the requisite time and effort may be universal problems in medical practice, as shown in this study. Another possible barrier to guideline implementation in Taiwan may be the reimbursement guidelines used by the Bureau of National Health Insurance, which recommend statin therapy only for those AMI patients with LDL-C levels $\geq$ 130 mg/dL. Since the LDL-C levels may be spuriously low for several weeks following an AMI, this may preclude the prescription of a statin for those patients. Even though we demonstrate in the present study that continuous statin therapy was associated with a better clinical outcome irrespective of baseline LDL-C levels, the current reimbursement guidelines may restrain the use of statin in those patients with LDL-C levels < 130 mg/dL. Therefore, one of the possible causes of lower statin prescription rate in the nonadherent group in the present study may be due to the relatively low baseline LDL-C level, instead of being due to poor guideline adherence. To solve this problem, it is clearly important to arrange follow-up tests about 6 weeks after discharge, when the patients with borderline values can be reassessed for statin therapy.

Given that the rate of emergency PCI was significantly higher in the adherent group compared with the nonadherent group, that continuous statin therapy at the time of PCI was an independent predictor of outcomes, and that adherent patients were also more likely to be treated with anti-platelet agents, angiotensin-converting enzyme inhibitors or angiotensin receptor blockers, or beta-blockers in the present study, whether emergency PCI treatment and concurrent medications affect the cli-

nical outcomes is a major concern. In the multivariate Cox proportional hazards analysis model, we found that there was no independent association between emergency PCI and medications other than statins and clinical outcomes in multivariable analyses.

Emergency CABG was the strongest predictor of clinical outcomes in the present study and most of the patients receiving emergency CABG were not taking continuous statins. The higher incidence of emergency CABG in the nonadherent group may account for a significant proportion of the difference in event survival between the two groups. It has been reported that preoperative statin therapy may also reduce the risk of early mortality and the composite outcome of stroke and 30-day all-cause mortality after CABG surgery.[25] Therefore, further investigation of how to facilitate the prescription of statins and the effects of statin treatment on those patients is warranted.

Since the prevalence of hyperlipidemia was significantly greater and the serum levels of total cholesterol and LDL-C on admission were significantly higher in patients receiving continuous statin therapy compared with patients not taking continuous statins, the question of whether preadmission hyperlipidemia and baseline cholesterol levels affect the clinical outcomes is also a major concern. To answer this question, we included the history of hyperlipidemia and LDL-C levels into the multivariate analysis model. Our data demonstrated that the history of hyperlipidemia and the LDL-C levels did not attenuate the association between statin use and clinical outcomes. That is, continuous statin therapy was associated with a better clinical outcome regardless of the presence of hyperlipidemia and baseline LDL-C levels.

Study limitations

Although this retrospective cohort study extends the results of previous studies suggesting that statin therapy may be of benefit in AMI patients, the present study is not without limitations. Firstly, administration of statin therapy in our study was neither prospective nor randomized, but was at the discretion of the treating physician. Despite careful use of models to adjust for potential factors that may affect clinical outcomes, immeasurable factors may still exist and residual confounding is always possible. Physician bias may have influenced patient selection, statin type and dose. Secondly, we were unable to determine the influence of the duration of statin therapy prior to AMI on the risk of adverse clinical outcomes during follow-up, since the duration of statin therapy before AMI was not measured or controlled in the present study. Actually, the pre-admission statin treatment can influence the prognosis. Furthermore, the compliance of statin therapy was assessed through chart review and telephone contacts and continuous statin therapy was defined as more than 85% of statin intake throughout the follow-up period. The effects of intermittent statin therapy on those AMI patients with less than 85% of statin intake cannot be determined in the present study. Finally, this study was conducted at a single tertiary referral medical center, and the results may in part reflect this setting and the types of providers and patients associated with it. Additional studies are needed to determine the generalization of our findings.

CONCLUSION

Our data suggest that continuous statin therapy in AMI patients may be beneficial in reducing cardiac morbidity and mortality. The results further support a growing body of evidence suggesting that statins should be prescribed to all patient recovery from AMI. However, the use of statins in AMI patients in real-world practice has been low and innovative approaches will be required to enhance their use.

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急性心肌梗塞患者 Statin 藥物之使用率偏低：單一醫院之經驗

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背景　當前的美國臨床治療指引建議所有急性心肌梗塞患者出院時都應處方 Statin 藥物，然而國內迄今這方面之資料付諸闕如。本研究之目的即在探討現今國內急性心肌梗塞患者使用 Statin 藥物之狀況以及使用 Statin 藥物對臨床預後的影響。

方法及結果　本研究回溯分析了 325 位 (平均年齡 62 ± 13 歲；男女比 258/67) 因急性心肌梗塞入院之患者。Statin 藥物之使用與否取決於各處方之主治醫師。病人依是否連續使用 Statin 藥物分為兩組：連續服用 Statin 藥物者有 167 位，占 51%；未連續服用 Statin 藥物者有 158 位，占 49%。連續服用 Statin 藥物之定義為自因急性心肌梗塞入院到追蹤結束止其服用 Statin 藥物之順從性至少 85% 者；未服用 Statin 藥物或斷續服用 Statin 藥物，其服藥順從性未達 85% 者，視為未連續服用 Statin 藥物。分析發現連續使用 Statin 藥物可顯著降低未來發生不良臨床事件之風險 (連續服藥者之不良事件發生率為 38%；未連續服藥者為 68%；$P < 0.0001$)。多變項分析校正各項可能影響預後之臨床指標後，連續服用 Statin 藥物者與未連續服藥者之危險比為 0.56 (95% 信賴區間為 0.32 至 0.97，P 值為 0.039)。

結論　急性心肌梗塞患者連續使用 Statin 藥物可明顯降低日後發生不良臨床事件之風險，然而目前僅約五成左右的使用率與臨床治療指引所建議者相比仍偏低，表示在實際臨床治療上提升急性心肌梗塞患者 Statin 藥物的使用，仍有值得努力的空間。

關鍵詞：Statin 藥物、急性心肌梗塞、臨床預後。