Recurrent Myocardial Infarction After Primary Percutaneous Coronary Intervention for ST-Segment Elevation Myocardial Infarction

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The determinants and prognostic value of recurrent myocardial infarction (MI) in a contemporary cohort of ST-segment elevation MI patients treated with primary percutaneous coronary intervention (PPCI) and stenting are currently unknown. We investigated the predictors and prognostic impact of recurrent MI on subsequent clinical outcome in 1,700 ST-segment elevation MI patients treated with PPCI and stenting between January 1, 2003, and July 31, 2008. Two hundred forty patients had a recurrent MI during a median follow-up of 4 years and 7 months (Kaplan Meier estimate 21.2%). By multivariable analysis, recurrent MI was associated with a higher risk of subsequent cardiac mortality (hazard ratio [HR] 6.86, 95% confidence interval [CI] 4.24 to 8.72), noncardiac mortality (HR 2.02, 95% CI 1.10 to 3.69), stroke (HR 3.68, 95% CI 2.02 to 6.72), and Global Use of Strategies to Open Occluded Coronary Arteries criteria severe or moderate bleeding (HR 3.17, 95% CI 1.79 to 5.60). Early recurrent MI (within 1 day of the initial PPCI) was associated with higher unadjusted cardiac mortality rates (64.4%) compared with recurrent MIs occurring ≥1 day after PPCI. However, after multivariable adjustment, late recurrent MI (occurring >1 year after PPCI) was associated with the highest risk of subsequent cardiac mortality (HR 7.98, 95% CI 5.05 to 12.6). The risk of cardiac death was irrespective of the presence of persistent ST-segment elevation during the recurrent MI. In conclusion, recurrent MI after PPCI remains a relatively common complication in contemporary practice and confers a significantly increased risk of death, stroke, and bleeding. **(Am J Cardiol 2014;113:229−235)**

Recurrent myocardial infarction (MI) after ST-segment elevation MI (STEMI) is associated with increased morbidity and mortality.[1−3] Fortunately, however, mortality rates after recurrent MI have recently been shown to be declining over the past 2 decades.[4] The introduction of new high-sensitive biomarker assays has enabled the detection of recurrent MIs with smaller amounts of myocardial necrosis, which may explain in part the reduced mortality after recurrent MI. Moreover, current treatment strategies, including advances in revascularization therapy have decreased mortality after recurrent MI.[5] Routine stenting of the culprit lesion is recommended over balloon angioplasty during primary percutaneous coronary intervention (PPCI) to prevent coronary restenosis.[6] Although treatment with bare-metal or drug-eluting stents has not resulted in reduced rates of recurrent MI after PPCI, it is possible that clinical and angiographic correlates of recurrent MI have changed with the introduction of coronary stents.[7] These correlates have not been well-described in a contemporary cohort of STEMI patients treated with coronary stenting and double or triple antithrombotic therapy, however. Therefore, the aim of this study was to investigate the predictors and clinical outcome after recurrent MI within 5 years' follow-up after PPCI in STEMI patients treated with double antiplatelet therapy.

Methods

The data analyzed in this study were obtained from STEMI patients who were accepted for PPCI at the Academic Medical Center, University of Amsterdam, between January 1, 2003, and July 31, 2008. The study complied with the Declaration of Helsinki, and the local ethics committee approved the study protocol. In general, patients qualified for PPCI if they had typical ischemic chest pain and at least 1-mm ST-segment elevation in ≥2 contiguous leads, a new left bundle branch block, or a true posterior MI. The PPCI and adjunctive pharmacologic treatment were performed according to American College of Cardiology, American Heart Association, and European Society of Cardiology guidelines. Patients received a standard 300- to 600-mg loading dose of clopidogrel. If a coronary stent was implanted, clopidogrel was prescribed

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See page 235 for disclosure information.

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Table 1
Baseline characteristics for patients with and without recurrent myocardial infarction

Variable	Recurrent MI		p Value
	Yes (n = 240)	No (n = 1,460)	
Men	166 (69.2%)	1,037 (71.0%)	0.56
Age (yrs), median (IQR)	63 (53−76)	62 (52−71)	0.075
BMI, median (IQR)	26.3 (24.0−29.1)	26.1 (24.2−28.7)	0.26
History of			
Diabetes mellitus	55 (22.9%)	171 (11.7%)	<0.001
IDDM	17 (7.1%)	43 (2.9%)	
NIDDM	38 (15.8%)	128 (8.8%)	
Hypertension	108 (45.0%)	527 (36.1%)	0.008
Dyslipidemia	66 (27.5%)	309 (21.2%)	0.028
Previous stroke or TIA	16 (6.7%)	91 (6.2%)	0.80
Peripheral artery disease	23 (9.6%)	75 (5.1%)	0.006
Preexistent malignant disease	18 (7.5%)	110 (7.5%)	0.99
Recent surgery (<10 days)	1 (0.4%)	19 (1.3%)	0.24
Bleeding	14 (5.8%)	48 (3.3%)	0.051
Current smoking	105 (43.8%)	670 (45.9%)	0.54
Previous MI	43 (17.9%)	139 (9.5%)	<0.001
Previous PCI	27 (11.3%)	101 (6.9%)	0.018
Previous CABG	9 (3.8%)	21 (1.4%)	0.012
Family history CAD	95 (39.7%)	552 (37.8%)	0.60
Laboratory values			
Hemoglobin (mmol/L), median (IQR)	8.8 (8.0−9.4)	8.9 (8.2−9.5)	0.25
Leucocyte count ($\times 10^9$/L)	11.2 (9.1−14.3)	11.3 (8.9−14.4)	0.77
Creatinine clearance (ml/min/1.73 m^2), median (IQR)	84.2 (62.8−119.5)	93.0 (70.0−118)	0.064
Thrombocyte count ($\times 10^9$/L)			0.55
<150	7/239 (2.9%)	58/1,444 (4.0%)	—
150−400	226/239 (94.6%)	1,337/1,444 (92.5%)	—
>400	6/239 (2.5%)	49/1,444 (3.4%)	—

BMI = body mass index; CAD = coronary artery disease; IDDM = insulin dependent diabetes mellitus; IQR = interquartile range; NIIDM = no−insulin dependent diabetes mellitus; TIA = transient ischemic attack.

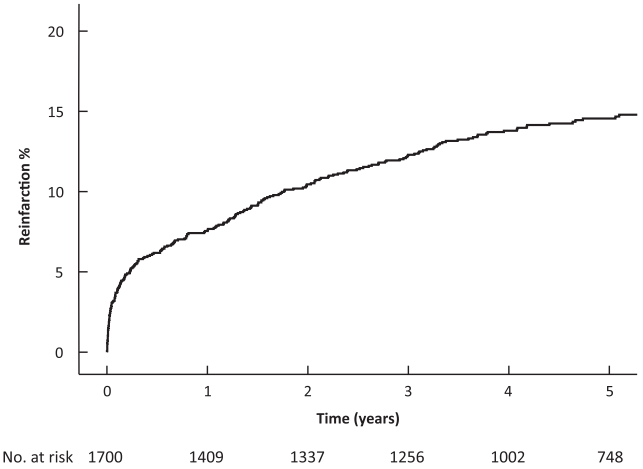

Figure 1. Cumulative incidence of recurrent MI.

for ≥1 month to patients with a bare metal stent and for 6 to 12 months to patients with a dug-eluting stent. Patients were routinely pretreated with 300 mg aspirin and 5,000 IU unfractionated heparin. An additional heparin bolus was administered at the catheterization laboratory if necessary to achieve a targeted activated clotting time of 300 seconds followed by an infusion of 12 U/kg/h with titration to achieve a target activated partial thromboplastin time (aPTT) of 1.5 to 2.0 times the control. Glycoprotein IIb/IIIa inhibitors were used at in a bailout setting at the discretion of the operator.

Procedural and angiographic data were prospectively collected by interventional cardiologists and specialized nurses in a dedicated database. Chart review for consecutive STEMI patients with available aPTT measurements was performed in the context of a study designed to investigate the relationship between aPTT and clinical outcome in STEMI patients treated with PPCI. A detailed description of the study protocol has been previously published.[8] We obtained clinical history, detailed information on peri-procedural treatment and follow-up of clinical outcome, including recurrent MI, stroke, stent thrombosis, and bleeding by reviewing inpatient and outpatient charts in the tertiary percutaneous coronary intervention (PCI) center and referring hospitals between 2011 and 2012. For every patient, we systematically checked inpatient charts of every hospital admission for the occurrence of the aforementioned clinical events. Follow-up of clinical events was censored at the actual date of chart review. Patients whose whereabouts could not be traced were considered lost to follow-up from the date of last known medical contact. Follow-up information regarding vital status was obtained from computerized, long-term mortality records from the National Death Index between January 1, 2012, and April 30, 2012. If a patient could not be identified in these records (e.g., foreign patients), censoring was at the date of last contact.