Primary PCI for acute myocardial infarction

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5

Heart Failure and Age in Primary PCI

CHAPTER 5

The Prognostic Importance of Heart Failure and Age in PatientsTreated with Primary Angioplasty

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Abstract

Background. Effective risk stratification is essential in the management of patients with acute myocardial infarction. Available models have not yet been studied and validated in patients treated with primary angioplasty for acute myocardial infarction.

Methods. The prognostic value of heart failure defined by Killip class and age upon admission and the impact of success and failure of the angioplasty procedure was studied in 1702 patients consecutive patients treated with primary angioplasty.

Findings. The combination of Killip class and age is a strong predictor of 30-day mortality and categorizes patients in subgroups with 30-day mortality risks ranging from 0.5% to 70%. Angioplasty failure results in a high 30-day mortality, in particular in patients with Killip class $\geq$ II and/or age $\geq$ 70 years. A large majority of patients (72%) characterized by Killip class I and age < 70 years, can be identified with a 0.5% risk of death at 30 days.

Interpretation. The presence of heart failure (Killip class) and age predicts 30-day mortality in patients on their way to the catheterization laboratory for primary angioplasty. This simple and effective early risk stratification, in combination with success and failure of the primary angioplasty, can be used to direct subsequent patient management.

Introduction

The short and medium term prognosis of patients with acute myocardial infarction has been investigated extensively, and the identification of factors that can be used to predict clinical outcome has been a challenge since the late 1960s (1-8). The introduction into clinical practice of effective treatments has made a risk assessment for individual patients even more important. As the efficacy of therapeutic intervention in acute myocardial infarction is time dependent, the risk profile of every single patient should be available immediately when the patient enters the medical care system. Low risk patients may be candidates for admission to a step-down unit instead of a coronary care unit and can often be discharged form the hospital after a few days (4,9). Early identification of high risk patients allows the investigation and implementation of adjunctive measures to limit myocardial damage and improve prognosis. In patients with acute ST elevation myocardial infarction treated with thrombolysis, hemodynamics, age, infarct location, a history of diabetes, hypertension or angina and time to reperfusion therapy all have an independent influence on clinical outcome (4-6). This makes an algorithm to predict outcome in thrombolysis patients somewhat more complex, although several simple and practical proposals have been validated (10,11). However, a similar analysis for patients treated with primary angioplasty has not yet been published. Analysis of the PCAT data (12), has shown that in patients treated with primary angioplasty for acute ST elevation myocardial infarction, hemodynamics at admission and age are the only two clinical baseline characteristics, independently associated with 30-day mortality in multivariate analysis (13). Therefore, we sought to investigate the predictive value of presence of heart failure using the Killip classification (1) and age for early clinical risk stratification in 1702 consecutive patients treated with primary angioplasty for acute ST elevation myocardial infarction.

Methods

All patients treated with primary angioplasty in our hospital from 1994 to 2000, for acute ST elevation myocardial infarction, presenting within 6 hours after symptom onset, were included in this analysis. Electrocardiographic criteria were ST segment elevation of $\geq$ 1 mm in two or more contiguous leads. Baseline clinical data, including Killip class were recorded immediately upon admission in a case record form, before angiography and angioplasty, and all data were entered into a dedicated database. Medication at presentation was not recorded. The primary aim of the risk stratification was the prediction of death from any cause within 30 days after the acute event. No patient was lost to follow-up.

Results

From 1994 to 2000, 1792 patients were admitted at our hospital for acute myocardial infarction and 1702 (95%) patients presented to our hospital within 6 hours after symptom onset and were treated with primary angioplasty for acute ST elevation myocardial infarction. Age ranged from 27 to 91 years, with a mean (±SD) of 60 (±12) years, 80% of the patients were male, 51% had an anterior wall infarct location, 12% had a previous myocardial infarction, 8% had a history of diabetes, 52% of patients had an ischemic time from symptom-onset to presentation of < 3 hours, and 48% had an ischemic time between 3 and 6 hours. From all patients, absence or presence of pre infarction angina was documented in 1088 patients. Preinfarction angina was defined by at least one episode of chest pain in the 72 hours before myocardial infarction. 442 patients had pre infarction angina and 646 patients no pre infarction angina and mortality was not different in both groups, respectively (1.6% vs. 1.4%, p=0.80). The use of glycoprotein (GP) IIb-IIIa inhibitors was documented in 544 patients. In patients treated with GP IIb-IIIa inhibitors (n=153) mortality was not different compared with patients not treated with GP IIb-IIIa inhibitors (n=391), respectively (1.3% vs. 2.3%, p=0.74).

The relation between Killip class and 30-day mortality is shown in Table 1 and the relation between age and 30-day mortality is shown in Table 2.

Table 1. Killip class at presentation and 30-day mortality in 1702 patients treated with primary angioplasty for acute myocardial infarction.

Killip Class		30-day Mortality
I	(N=1513)	1.1%
II	(N=102)	7.8%
III	(N=47)	21.3%
IV	(N=40)	37.5%

Table 2. Age and 30-day mortality in 1702 patients treated with primary angioplasty for acute myocardial infarction.

Age		30-day Mortality
< 60 yr.	(N=787)	1.4%
60-70 yr.	(N=569)	2.5%
>70 yr.	(N=346)	7.2%

To study their independent value we performed multivariate analysis with a logistic regression analysis model with variables that were associated with higher mortality in the univariate analysis: Age ≥70 years, Killip class ≥ 2, anterior location of myocardial infarction, blood pressure at entry <100 mm Hg (Table 3). Killip class ≥ 2 and age ≥ 70 years were the strongest predictors for 30-day mortality. Combining the information from these two parameters, a large group of patients can be identified with Killip class I and age <70 years: 1229 of 1702 patients (72%), with a very low risk of 0.5%, 30-day mortality. Patients with Killip class I and age >70 years have an intermediate risk with a 3.5% 30-day mortality, and patients with Killip class ≥ II have a 11% 30-day mortality, details can be found in Figure 1. The primary angioplasty procedure was successful in restoring patency of the infarct related artery in 1612 of 1702 patients (94.7 %), and failed in 90 of 1702 patients (5.3 %). The prognostic information of Killip class and age showed a similar pattern in these two groups, although failed angioplasty resulted in high 30-day mortality rates, see Figure 2 A and B.

Table 3. Clinical variables as risk factors of 30-day mortality in 1702 patients treated with primary angioplasty for acute myocardial infarction.

	RR*	(95%CI)	P-value
Killip class ≥ 2 vs. Killip class 1	10.9	(5.1-23.1)	<0.001
Age ≥ 70 vs. Age < 70 (years)	3.6	(1.8-7.0)	<0.001
BP syst <100 vs. BP syst ≥ 100 (mm Hg)	2.4	(1.1-5.2)	0.02
Anterior MI vs. Non-Anterior MI	1.9	(1.0-3.8)	0.06

BP = Blood Pressure, MI = Myocardial Infarction,

*RR = Risk Ratios Taken From The Logistic Regression Analysis

Figure 1: The relation between and combined effect of Killip class and age in all patients treated with primary angioplasty on 30-day mortality.

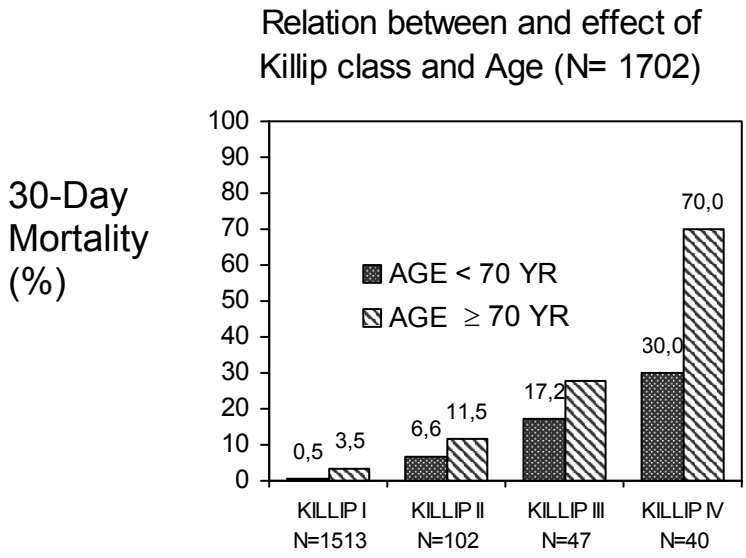


Figure 2A: Relation between Killip class, age and 30-day mortality:
the impact of success and failure of the primary angioplasty procedure.

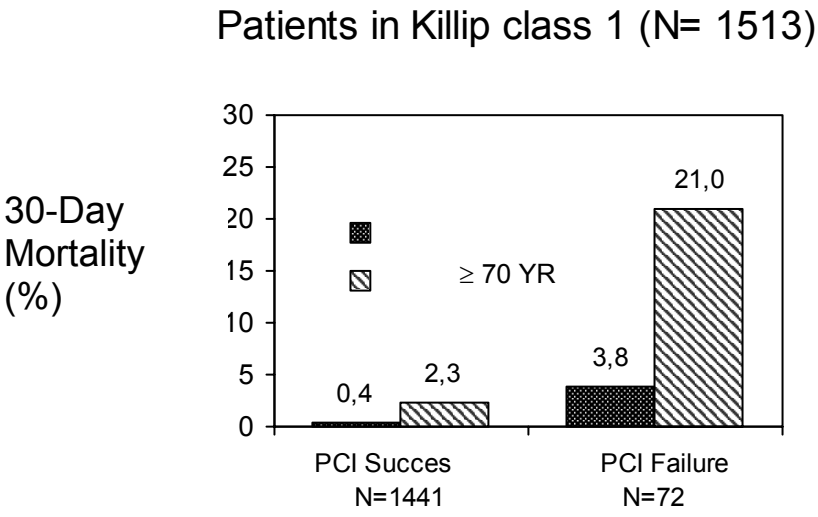
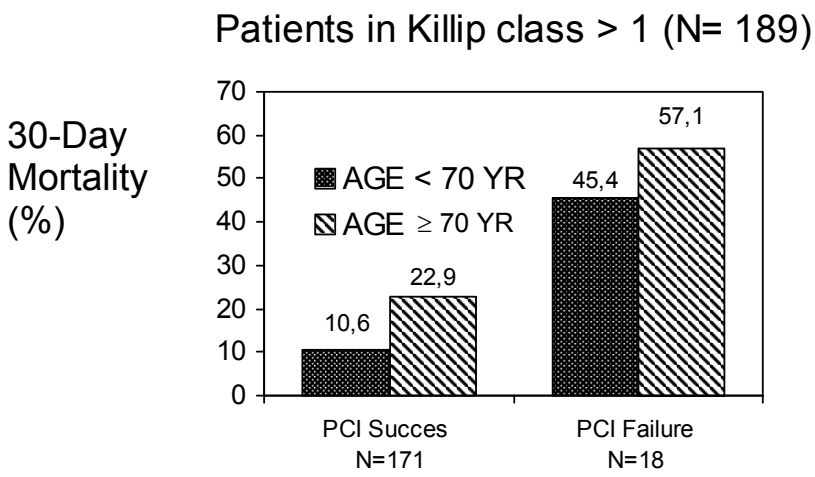


Figure 2B: Relation between Killip class, age and 30-day mortality:
the impact of success and failure of the primary angioplasty procedure.



Discussion

The major finding from this study is that based on Killip class and age, a clinically meaningful acute risk stratification can be performed in patients on their way to the catheterization laboratory to undergo angioplasty for acute ST segment elevation myocardial infarction. A large group of patients can be identified with a very low 30-day mortality risk. Provided that the angioplasty procedure is successful, they can be managed in a similar way to patients treated with angioplasty for stable and unstable angina, in a step-down unit or medium care facility, and they are candidates for early discharge from the hospital and out-patient rehabilitation. By identifying the patients at intermediate or high risk early in their hospital course, coronary care or intensive care beds can be used selectively for the patients who really need them, and it allows the early consideration of additional therapeutic measures to improve clinical outcome. Based on Killip class, age and primary angioplasty procedural success or failure, appropriate patient management is facilitated. Previous attempts to risk stratify patients with acute myocardial

infarction have mainly be done in patients treated with thrombolytic therapy and most have used multiple clinical factors (4-8). For instance, in the GUSTO 1 trial, 16 factors were associated with 30-day mortality (5). However, the use of many factors may increase prognostic accuracy, but it seems likely that this confuses rather than helps practicing physicians. The GISSI study group (8), the TIMI study group (6), the InTime II study group (10) and the NRMI study group (11) have all published simple and more or less practical assessments of risk of short term (in-hospital or 30-day) mortality. In the NRMI cohort of primary angioplasty patients, the TIMI risk score developed in thrombolysis patients performed in the angioplasty patients in a similar way as in patients treated with thrombolysis (11). Although the TIMI risk score gives points for 9 items, most weight is given to hemodynamics and age (11). An InTime II substudy calculated a risk index based only on heart rate, systolic blood pressure and age (10). However, the major difference of all these studies and the findings from this study is the accurate identification of a large majority of patients with a very low risk, whereas the previous studies could only identify a minority of low risk patients with acute myocardial infarction, limiting the practical implications.

A pooled analysis of 3 trials of the PAMI study group has been performed to study the predictive value of the Killip classification (14). Class IV patients were excluded. They showed a clear relation between in-hospital and 6 months mortality with Killip classes I, II and III, and reconfirmed the association between Killip class and many other clinical variables, such as age, history of diabetes, blood pressure, heart rate, left ventricular ejection fraction, peak creatine phosphokinase, use of intra-aortic balloon counter pulsation, incidence of renal failure, major arrhythmias and major bleeding. In their multivariate model to predict mortality, left ventricular ejection fraction played a prominent role and therefore this algorithm cannot be applied upon presentation.

Study limitations

Patients with a presentation more than 6 hours after symptom onset were excluded from this analysis, as these patients form a heterogeneous population, with

different clinical characteristics (13,15). The impact of the use of beta-blockers and aspirin before admission could not be studied, since we did not record medication at presentation. However, previous investigations have shown that less than 10% of the patients with acute myocardial infarction in our area are using beta-blockers or aspirin before acute myocardial infarction. Therefore, it seems unlikely that this may have influenced our results. Treatment with GP IIb-IIIa inhibitors only became established towards the end of the study period. It was documented in only 544 and was started after angioplasty and at the operators' discretion. Therefore, the possibility to study the impact of these agents was limited. Although this is a post-hoc analysis, all data used in this study have been gathered prospectively, and the residents who actually filled in the case record forms, did so as part of routine clinical practice. The 1702 patients described in this study come from a single high volume interventional cardiology department with a catheterization laboratory and coronary care unit staff dedicated to the task of performing primary angioplasty 24 hours a day, 7 days a week. This will certainly have played a role in the low mortality rates in most subgroups of patients (16-17).

Implications

Based on Killip class and age, procedural success or failure patients treated with primary angioplasty for acute myocardial infarction can be risk stratified in a simple, effective and accurate way. This information can be used to facilitate further management. In the many low risk patients, reductions in hospital stay and costs are possible, and in patients at intermediate or high risk early consideration of additional therapeutic measures may result in improved clinical outcome.

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6

Circadian Variation in Outcome of Primary PCI