



## Primary PCI for acute STEMI patients with and without diabetes mellitus

René J van der Schaaf, José PS Henriques, Jacobijne J Wiersma, Karel T Koch, Jan Baan Jr, Karla J.J. Mulder, Joseph D Durrer, Jan G.P. Tijssen, Jan J Piek and Robbert J de Winter

*Heart* published online 12 May 2005;  
doi:10.1136/hrt.2004.059675

---

Updated information and services can be found at:  
<http://heart.bmj.com/cgi/content/abstract/hrt.2004.059675v1>

*These include:*

### Rapid responses

You can respond to this article at:  
<http://heart.bmj.com/cgi/eletter-submit/hrt.2004.059675v1>

### Email alerting service

Receive free email alerts when new articles cite this article - sign up in the box at the top right corner of the article

---

### Notes

---

**Online First** contains unedited articles in manuscript form that have been peer reviewed and accepted for publication but have not yet appeared in the paper journal (edited, typeset versions may be posted when available prior to final publication). Online First articles are citable and establish publication priority; they are indexed by PubMed from initial publication. Citations to Online First articles must include the digital object identifier (DOIs) and date of initial publication.

---

To order reprints of this article go to:  
<http://www.bmjournals.com/cgi/reprintform>

To subscribe to *Heart* go to:  
<http://www.bmjournals.com/subscriptions/>

**Primary PCI for acute STEMI patients with and without Diabetes Mellitus.**

René J. van der Schaaf, MD, José PS Henriques, MD, PhD, Jacobijne J. Wiersma, MD, Karel T. Koch, MD, PhD, Jan Baan Jr, MD, PhD, Karla J. J. Mulder, MSc, Joseph D. Durrer, MD, PhD, Jan G.P. Tijssen, MD, PhD, Jan J. Piek, MD, PhD, Robbert J. de Winter, MD, PhD

Department of Cardiology, Academic Medical Centre, Amsterdam, The Netherlands

There are no conflicts of interest or financial disclosure

The Corresponding Author has the right to grant on behalf of all authors and does grant on behalf of all authors, an exclusive licence (or non exclusive for government employees) on a worldwide basis to the BMJ Publishing Group Ltd and its Licensees to permit this article (if accepted) to be published in HEART editions and any other BMJ PGL products to exploit all subsidiary rights

Corresponding author:  
Dr. J.P.S. Henriques  
Department of Cardiology  
Academic Medical Centre  
Meibergdreef 9  
1105 AZ Amsterdam  
The Netherlands  
Telephone number: ++31.20.5669111  
Fax number: ++31. 20.6962609  
E-mail: [j.p.henriques@amc.uva.nl](mailto:j.p.henriques@amc.uva.nl)

## ABSTRACT

**Objective:** Acute ST segment elevation myocardial infarction (STEMI) patients with diabetes (DM) constitute a high risk patient group. Primary angioplasty (PCI) is the optimal treatment for STEMI. There is limited information about outcome in DM patients treated with PCI. We studied 1 year mortality in STEMI patients with and without diabetes, treated with PCI.

**Design:** Retrospective database analysis of prospectively entered data

**Setting, Patients and Main outcome measures:** From 1308 STEMI patients treated with PCI, 174 (13.3%) patients had diabetes mellitus. DM patients were categorized according to preadmission therapy: oral (NIDDM) or insulin (IDDM) therapy. Follow-up was 1 year.

**Results:** Mortality was 7.2% in non-DM and 17.8% in DM patients (OR 2.9, 95%CI 1.8-4.3,  $p < 0.001$ ). Mortality rate was 14.3% in NIDDM ( $n=125$ ) and 27.1% in IDDM ( $n=48$ ) patients (OR 2.2, 95%CI: 1.0-5.0,  $p < 0.05$ ). DM patients presented more often with cardiogenic shock (OR 1.6, 95%CI: 1.0-1.7,  $p=0.03$ ), had more often coronary calcifications (OR 1.6, 95%CI: 1.1-2.3,  $p=0.01$ ) and more PCI failure (OR 3.0, 95%CI: 1.8-5.1,  $p < 0.001$ ) compared with nonDM patients. Independent predictors for mortality were: shock (OR 5.4 95%CI: 3.3-8.7,  $p < 0.001$ ), PCI failure (OR 3.1, 95%CI:1.6-6.2,  $p=0.001$ ) IDDM (OR 3.2, 95%CI:1.2-8.7,  $p=0.018$ ), NIDDM (OR 2.7, 95%CI:1.2-5.7,  $p=0.011$ ) and coronary calcifications (OR 1.7, 95%CI:1.0-2.7,  $p=0.043$ ).

**Conclusions:**STEMI patients with DM more often present with shock, have more severe coronary artery disease and more often have PCI failure. IDDM patients have a 2 times higher mortality rate compared with NIDDM and an approximately 4 times higher mortality rate compared with patients without diabetes.

**Keywords:** myocardial infarction, angioplasty, diabetes mellitus, insulin

Acute ST segment elevation myocardial infarction (STEMI) patients with diabetes (DM) have an increased mortality and morbidity when compared to patients without diabetes (1). There is limited information about clinical outcome of STEMI patients with diabetes treated with reperfusion therapy. Furthermore, DM patients have a higher rate of thrombolysis failure (2,3). Currently, there is only limited information of long term outcome of patients with diabetes treated with primary coronary intervention (PCI) (4) which is currently considered to be the reperfusion therapy of choice (5).

We therefore studied 1 year mortality in patients with and without diabetes a large cohort of acute STEMI patients treated with primary PCI. Furthermore, we studied the impact of preadmission therapy for diabetes, either oral medication or insulin therapy.

## METHODS

Between January 1997 and December 2002, 1463 consecutive and unselected patients were admitted to our hospital with acute STEMI. From the 1463 patients, 17 patients were lost to follow up and in another 138 patients data about DM status was not available. The remaining 1308 patients represent the study cohort. Follow-up information was obtained 1 year after the initial event by written questionnaire sent to all patients. If necessary outpatients' reports were reviewed, and general practitioners were contacted by phone. Baseline clinical and angiographic data were collected prospectively in a dedicated database. The patients were categorized in either patients without diabetes (nonDM) or with an established diagnosis of diabetes at admission (DM). DM patients were categorized according to preadmission therapy: either on oral therapy or diet controlled (NIDDM) or on insulin therapy (IDDM). IDDM patients included type 1 and type 2 DM. Patients treated with insulin in combination with oral medication were categorized as IDDM.

To find independent predictors of 1 year mortality we performed multivariate analysis with Cox proportional-hazards regression model.

## RESULTS

From the 1308 patients, 174 (13.3%) patients had a confirmed diagnose of DM at admission. Patients with DM were less often male (74.9% vs. 64.9%,  $p=0.006$ ), older (<60 years; 44.4% vs. 64.4%,  $p<0.001$ ), more often hypertensive (49.4% vs. 31.7%,  $p<0.001$ ), less smokers (34.5% vs. 55.2%,  $p<0.001$ ) and more often had a previous coronary event (previous PCI, STEMI or coronary bypass grafting; 40.8% vs. 20.3%,  $p<0.001$ ) compared with nonDM patients. A long ischemic time (>3 hours) was more often observed in DM patients compared with nonDM patients (54.7% vs. 44.3%,  $p=0.027$ ). Patients with DM had a higher incidence of cardiogenic shock at admission (13.2% vs. 8.3%,  $p=0.034$ ) and more frequently needed intra aortic balloon counter pulsation therapy (12.1% vs. 5.6%,  $p<0.001$ ) compared with nonDM patients. DM patients had more often multivessel disease (55.7% vs. 37.9%,  $p<0.001$ ), more coronary calcifications (27.6% vs. 19.5%,  $p=0.014$ ) and had less often successful PCI (86.6% vs. 95.2%,  $p<0.001$ ) compared with nonDM patients. Mortality, after 1 year follow up, was 8.9% ( $n=113$ ) in the whole cohort; 17.8% in DM patients and 7.2% in nonDM patients (OR 2.9, 95%CI 1.8-4.3,  $p<0.001$ ). From the 174 DM patients, 126 (72.4%) patients were on oral therapy (NIDDM) and 48 (27.8%) patients were on insulin therapy (IDDM) at admission. There were no differences in baseline and angiographic characteristics between IDDM and NIDDM patients. IDDM patients showed a trend towards more coronary calcifications (37.5% vs. 23.8%,  $p=0.071$ ) and less successful PCI (81.3% vs. 88.9%,  $p=0.184$ ) compared with NIDDM patients. Mortality rate was 27.1% in IDDM patients and 14.3% in NIDDM patients (OR 2.2, 95%CI:1.0-5.0,  $p<0.05$ ). Multivariate analysis revealed that significant independent predictors for mortality were: cardiogenic shock at presentation, PCI Failure, IDDM, NIDDM and coronary calcifications (see Table 1).

## DISCUSSION

This study reconfirms that even with the reperfusion therapy of choice, STEMI patients with diabetes have an increased long-term mortality when compared to patients without diabetes. They have different baseline characteristics compared with nonDM patients. DM patients also present with a higher incidence of cardiogenic shock at presentation, possibly at least partly due to longer ischemic time. Furthermore, DM patients more often had PCI failure compared with nonDM, possibly also as a consequence of a longer ischemic time. Some angiographic differences may also partly explain the difference in PCI success. Both coronary calcifications and a higher rate of multivessel disease are also associated with more complicated PCI procedures and were more often present in DM patients.

The second finding is that preadmission therapy for diabetes is an independent predictor for 1 year mortality. Patients requiring insulin therapy are patients with long standing type 1 DM and patients with type 2 DM without adequate glycemic regulation on oral medication. These IDDM patients will mostly have long standing type diabetes and type 2 patients DM patients on insulin therapy at admission have an approximately 4 times higher mortality rate when compared with nonDM patients and a 2 times higher mortality rate when compared with DM patients on oral therapy at admission. In our report approximately 13% of the patients were previously diagnosed with DM. From all DM patients approximately 28% were on insulin therapy at admission, in agreement with large registries.

## LIMITATIONS

We did not routinely estimate HbA1c or perform tests to detect DM on admission nor during the follow-up. Despite the relatively large sample size, the absolute number included in each DM patient category is somewhat small. Only 23% of all patients were treated with abciximab.

## CONCLUSION

Acute STEMI patients with diagnosed diabetes more often present with cardiogenic shock and have more severe coronary disease and PCI failure. After primary PCI for STEMI, 1 year mortality rate is 7.2% in patients without diabetes and 17.8% in patients with diabetes. In diabetes patients on oral therapy at time of admission for STEMI, 1 year mortality rate is 14.3% and 27.1% in diabetes patients on insulin therapy. Preadmission therapy for DM is an independent predictor of 1 year mortality. Even after primary PCI for acute STEMI, diabetes patients on insulin therapy are a subgroup with an approximately 4 times higher mortality rate compared with patients without diabetes and a 2 times higher mortality rate when compared with diabetes patients on oral therapy in current daily "real life" clinical practice.

## References

1. Mak KH, Moliterno DJ, Granger CB et al. Influence of diabetes mellitus on clinical outcome in the thrombolytic era of acute myocardial infarction. GUSTO-I Investigators. Global utilization of streptokinase and tissue plasminogen activator for occluded coronary arteries. *J Am Coll Cardiol* 1997;30:171–179.
2. Hsu LF, Mak KH, Lau KW et al. Clinical outcomes of patients with diabetes mellitus and acute myocardial infarction treated with primary angioplasty or fibrinolysis. *Heart* 2002;88:260–265.
3. Zairis MN, Lyras AG, Makrygiannis SS et al. Type 2 diabetes and intravenous thrombolysis outcome in the setting of ST elevation myocardial infarction. *Diabetes Care* 2004;27:967-971.
4. Timmer JR, Ottervanger JP, Thomas K et al. on behalf of the Zwolle myocardial infarction study group. Long-term, cause-specific mortality after myocardial infarction in diabetes. *Eur Heart J* 2004 ;25:926-931.
5. 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.

**Table 1.** Independent predictors of 1 year mortality in 1308 STEMI patients treated with primary PCI.

	RR*	(95%CI)	P-value
<b>Shock at presentation</b>	<b>5.405</b>	<b>3.311 – 8.771</b>	<b>&lt;0.001</b>
<b>PCI Failure</b>	<b>3.127</b>	<b>1.586 – 6.166</b>	<b>0.001</b>
<b>IDDM**</b>	<b>3.246</b>	<b>1.219 – 8.695</b>	<b>0.018</b>
<b>NIDDM**</b>	<b>2.673</b>	<b>1.248 – 5.714</b>	<b>0.011</b>
<b>Coronary calcification</b>	<b>1.680</b>	<b>1.016 – 2.777</b>	<b>0.043</b>
Family history	1.452	0.880 – 2.396	0.144
Multivessel disease	1.412	0.869 – 2.293	0.163
Age >60 years	1.402	0.808 – 2.439	0.229
Male	1.206	0.717 – 2.028	0.479
Ischemic time >180 minutes	1.206	0.766 – 1.901	0.417
Previous event	1.184	0.710 – 1.976	0.515
Hypertension	1.082	0.662 – 1.766	0.753
Smoking	0.801	0.493 – 1.302	0.371
Hypercholesterolaemia	0.704	0.393 – 1.261	0.238

---

STEMI: ST segment elevation myocardial infarction, PCI: percutaneous coronary intervention, NIDDM: patients with diabetes on oral therapy, IDDM: patients with diabetes on insulin therapy. Previous event: previous PCI or STEMI or coronary artery bypass grafting.

\* RR taken from the Cox regression analysis. **Significant predictors are in bold.**

\*\* Diabetes was entered as a categorical variable (no diabetes;NIDDM;IDDM)