CARDIOVASCULAR MEDICINE

Prognostic relations between inflammatory markers and mortality in diabetic patients with non-ST elevation acute coronary syndrome

P L Sanchez, J L Morinigo, P Pabon, F Martin, I Piedra, I F Palacios, C Martin-Luengo

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See end of article for authors' affiliations

Correspondence to: Dr P L Sanchez, Cardiac Unit, University Hospital, Paseo de San Vicente 58-182, 37007, Salamanca, Spain; pedrolsanchez@hotmail.com

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Objective: To determine the differences in the inflammatory status between diabetic and non-diabetic patients and to evaluate the usefulness of C reactive protein, fibrinogen, and leucocyte count as predictors of death in diabetic patients with unstable coronary disease.
Design: Nested case-control comparisons of the inflammatory status between diabetic and non-diabetic patients. Prospective cohort analysis of C reactive protein concentration, fibrinogen concentration, and leucocyte count as predictors of cardiovascular death in diabetic patients.
Setting: Coronary care unit in Spain.
Participants: 83 diabetic patients with non-ST elevation acute coronary syndrome and 83 sex and aged matched patients selected from 361 non-diabetic patients with non-ST elevation acute coronary syndrome.
Main outcome measures: Plasma concentrations of C reactive protein and fibrinogen, and leucocyte count. Investigators contacted patients to assess clinical events.
Results: Concentrations of C reactive protein and fibrinogen, and leucocyte count on admission were higher in diabetic than in non-diabetic patients (7 mg/l *v* 5 mg/l, p = 0.020; 3.34 g/l *v* 2.90 g/l, p = 0.013; and 8.8×10^9/l *v* 7.8×10^9/l, p = 0.040). Among diabetic patients, these values were also higher in those who died during the 22 month follow up (13 mg/l *v* 6 mg/l, p = 0.001; 3.95 g/l *v* 3.05 g/l, p < 0.001; and 11.4×10^9/l *v* 8.4×10^9/l, p = 0.005). After adjustment for confounding factors, diabetic patients in the highest tertile of C reactive protein had a hazard ratio for cardiovascular death of 4.51 (95% confidence interval (CI) 1.62 to 12.55). Similar hazard ratios were for fibrinogen 3.74 (95% CI 1.32 to 10.62) and for leucocyte count 3.64 (95% CI 1.37 to 9.68).
Conclusions: Inflammation appears more evident in diabetic than in non-diabetic patients with acute coronary syndrome. C reactive protein concentration, fibrinogen concentration, and leucocyte count constitute independent predictors of cardiovascular death in diabetics with unstable coronary disease.

Diabetes mellitus is widely recognised as being perhaps the most significant risk factor for the development of acute coronary syndromes.[1–2] Furthermore, when patients with diabetes develop clinical events, their prognosis is worse than that for non-diabetics.[3]

The basis for the excess risk of cardiovascular disease among diabetic patients has not been completely determined. Firstly, there is a high prevalence of conventional risk factors such as dyslipidaemia (high triglycerides, low high density lipoprotein, and small dense low density lipoprotein particles), hypertension, and obesity.[4–6] Secondly, diabetic patients are at increased risk for thrombosis formation as a consequence of increased platelet reactivity, increased concentrations and activity of coagulation factors, and decreased activity of antithrombotic factors and fibrinolytic system capacity resulting from overexpression of plasminogen activator inhibitor type 1.[7–10] Thirdly, insulin resistance, hyperinsulinaemia, hyperglycaemia, and advanced glycation end products also affect arterial wall physiology.[11–14] All these mechanisms favour systemic and coronary inflammation and accelerated progression and precipitation of atherothrombosis.[15 16] In fact, in diabetic patients with unstable angina coronary plaques have a higher incidence of plaque ulceration and intracoronary thrombus formation than in non-diabetics patients. Diabetic plaques usually have a greater lipid core burden and a richer inflammatory component and are more commonly complicated by overlying thrombosis.[17] In addition, inflammation is an important pathogenetic determinant of type 2 diabetes. C reactive protein concentration and leucocyte count have been shown to be independent predictors of the development of type 2 diabetes.[18 19] Anti-inflammatory agents, such as statins,[20] peroxisome proliferator activated receptor agonists,[21] and angiotensin converting enzyme inhibitors may also delay the onset of diabetes in high risk patients.[22]

Recently, systemic blood markers of inflammation have emerged as powerful predictors of coronary events in patients with unstable angina and after myocardial infarction.[23–29] However, very limited information is available concerning the concentrations of C reactive protein and fibrinogen and of leucocyte count in diabetic patients with unstable coronary artery disease. Thus, the present study aimed at determining the differences in the inflammatory status between non-diabetic and diabetic patients with non-ST elevation acute coronary syndrome, and evaluating and comparing the usefulness of C reactive protein concentration, fibrinogen concentration, and leucocyte count as predictors of long term mortality in diabetic patients.

METHODS

Patient population

A total of 83 of 119 consecutive patients with type 2 diabetes admitted to our coronary care unit with a diagnosis of non-Q

Abbreviations: CI, confidence interval; FRISC, Fragmin during instability in coronary artery disease; NHANES III, national health and nutrition examination survey III

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wave myocardial infarction or Braunwald class IIIB unstable angina from October 1998 to June 2000 were included in the study. Patients with ST elevation at admission (four patients), left bundle branch block (two patients), new Q waves of more than 0.04 seconds in at least two leads (two patients), type 1 diabetes (one patient), malignancy or inflammatory disease (six patients), surgery or major trauma in the previous two months (two patients), valvar heart disease (six patients), patients with previous myocardial infarction and ejection fraction $< 40\%$ (four patients), time from onset of symptoms to admission to the coronary care unit > 12 hours (five patients), and creatinine $\geqslant 176$ µmol/l were excluded from the study (four patients). To compare the differences in the inflammatory status between diabetic and non-diabetic patients, the study group was sex and age matched to 83 of 361 non-diabetic patients admitted to our coronary care unit with the same diagnosis and in the same period of time. All patients were initially treated medically and underwent coronary angiography and revascularisation when refractory or incapacitating angina and signs of severe ischaemia during exercise testing were present. Patients were followed up in a prospective manner. After patients were discharged, investigators contacted patients to assess clinical events. Clinical follow up was available for all patients (100%). Median follow up of diabetic patients was 22 months.

Laboratory assays and study protocol

Venous blood samples were obtained from all patients at the time of admission to the coronary care unit. C reactive protein concentrations were determined by turbidimetry with a commercially available kit (Hitachi model 717, Boehringer Mannheim, Mannheim, Germany). The lower detection limit was 1.3 mg/l. The interassay coefficient of variation was 6% and the intra-assay coefficient was 1.3%. A comparison of the C reactive protein determination with a nephelometric method gave a correlation coefficient of 0.991. Plasma concentrations of fibrinogen were measured by use of the Clauss method. Troponin I concentrations were measured by a paramagnetic particle chemiluminescent immunoenzymatic assay. Diabetes mellitus was defined as a fasting serum glucose concentration of 7.0 mmol/l (126 mg/dl) or more, a non-fasting glucose concentration of 11.1 mmol/l (200 mg/dl) or more, the participant's report of a physician's diagnosis of diabetes, or current use of diabetes medication.[30]

Statistical analysis

C reactive protein and fibrinogen concentrations and leucocyte count are presented as median and interquartile range. Non-parametric tests were used to compare C reactive protein and fibrinogen concentrations and leucocyte counts between groups (Mann-Whitney U test) and to determine correlations (Spearman's p test). Discontinuous variables were tested by a contingency χ^2 test. Diabetic patients were divided into tertiles on the basis of their C reactive protein and fibrinogen concentrations and leucocyte counts at admission. Diabetic patients in the highest tertile were compared with those with concentrations in the two lower tertiles. By forward stepwise logistic regression analysis, we calculated the relative odds ratios and 95% confidence intervals (CIs) for in-hospital cardiac death. We used Cox regression analyses with forward stepwise selection to calculate the adjusted hazard ratios and 95% CIs for death from cardiovascular causes for the total follow up period. Logistic and Cox regression analyses considered age $\geqslant 65$ years, sex, body mass index, current smoking, presence or absence of hypertension, previous coronary artery disease, presence or absence of a history of hyperlipidaemia, two or more anginal events in the previous 24 hours, ST segment depression $\geqslant 0.5$ mm at admission, troponin I >0.2 ng/ml on admission, diabetes treatment status, and the presence or absence of prior treatment with aspirin and statins. C reactive protein and fibrinogen concentrations and leucocyte count were thus entered as dichotomised variables, upper tertile versus lower tertile. For comparison with recent studies,[31] we evaluated the additive effect of C reactive protein and fibrinogen concentrations and leucocyte count in combination. We categorised diabetic patients on the basis of the number of increased inflammatory markers on admission: none, one, two, or all three. For the present analysis we used a cut off value of 10 mg/l for C reactive protein,[32] 10 000 cells/dl for leucocyte count,[28] and > 4.00 g/l for fibrinogen.[29]

Finally, event-free survival was analysed by the Kaplan-Meier method and the log rank test was used for to compare curves. A two sided probability value of $p < 0.05$ was considered significant.

RESULTS

Table 1 shows the baseline clinical characteristics of non-diabetic and diabetic patients. There were no differences in baseline characteristics between groups except for a higher smoking history in non-diabetic patients (43 (51.8%) *v* 27 (32.5%), $p = 0.01$). Almost one third of the patients in both groups had had a previous myocardial infarction, were taking aspirin at admission, and had higher concentrations of troponin I. Approximately 46% of non-diabetic and 55% of diabetic patients had ST segment depression $\geqslant 0.5$ mm on admission to the hospital. The mean time from the onset of chest pain to admission in the coronary care unit for diabetic patients was 4.6 (3.3) hours, similar to that for non-diabetic patients. The median C reactive protein and fibrinogen concentrations and the leucocyte counts were significantly higher at admission in the diabetic than in the non-diabetic patients (table 1).

The median duration of follow up of diabetic patients was 22 months. Nine (10.8%) diabetic patients died during hospitalisation and 18 (21.7%) during the entire follow up time (table 2). Compared with those who survived during the follow up, diabetic patients who died were older and a higher percentage were women. A larger percentage also were not taking statins and had ST segment depression at admission (table 3).

The median C reactive protein and fibrinogen concentrations and the leucocyte count were higher in diabetic patients who died than in those who survived during hospitalisation (18 mg/l *v* 6 mg/l, $p = 0.01$; 3.89 g/l *v* 3.18 g/l, $p = 0.004$; and 11.7 $\times 10^9$/l *v* 8.6 $\times 10^9$/l, $p = 0.054$) and during the entire follow up (13 mg/l *v* 6 mg/l, $p = 0.001$; 3.95 g/l *v* 3.05 g/l, $p < 0.001$; and 11.4 $\times 10^9$/l *v* 8.4 $\times 10^9$/l, $p = 0.005$).

The correlation coefficient between C reactive protein concentration and fibrinogen concentration was 0.43 ($p < 0.001$), between C reactive protein concentration and leucocyte count was 0.18 ($p = 0.105$), and between fibrinogen concentration and leucocyte count was 0.27 ($p = 0.015$). The coefficient correlations between troponin I and each of C reactive protein concentration, fibrinogen concentration, and leucocyte count at admission were weak and not significant (0.11, −0.01, and 0.07, respectively).

Coronary angiography was performed in 34 diabetic patients (41%); 13 (15.7%) before discharge and 21 (25.3%) during the follow up. No patients had normal coronary arteries (coronary stenosis $< 50\%$). Eight, eight, and 18 patients had one, two, or three vessel coronary disease, respectively. Two (5.9%) of the 34 diabetic patients had significant left main artery disease. The Kruskal-Wallis one way analysis of variance indicated that there was no relation between the number of diseased coronary arteries and either

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Table 1 Clinical data of non-diabetic and diabetic patients

	Non-diabetic (n = 83)	Diabetic (n = 83)	p Value
Median age (years)	71	71	1.000
Female sex	26 (31.3%)	26 (31.3%)	1.000
Hypertension	36 (43.4%)	39 (47.0%)	0.640
Smoking history	43 (51.8%)	27 (32.5%)	0.012
Hypercholesterolaemia	46 (55.4%)	47 (56.6%)	0.876
Body mass index ⩾25 kg/m^2	49 (59.0%)	52 (62.7%)	0.633
Stable angina >3 months before admission	22 (26.5%)	31 (37.3%)	0.134
Previous myocardial infarction	22 (26.5%)	24 (28.9%)	0.729
Aspirin at admission	31 (37.3%)	26 (31.3%)	0.414
Statins at admission	13 (15.7%)	10 (12.0%)	0.500
⩾2 anginal episodes in previous 24 hours	37 (44.6%)	28 (33.7%)	0.152
⩾ST segment depression ⩾0.5 mm at admission	38 (45.8%)	46 (55.4%)	0.214
Coronary angiography during the study	39 (47.0%)	34 (41.0%)	0.434
One vessel disease	13 (66.7%)	8 (23.5%)	0.356
Multivessel disease	26 (33.3%)	26 (76.5%)	0.356
Troponin I ⩾0.2 ng/ml at admission*	32 (38.6%)	29 (34.9%)	0.629
Mean (SD) time from onset of chest pain to admission (hours)	4.7 (3.0)	4.6 (3.3)	0.785
Median C reactive protein (mg/l)	5 (2, 8)	7 (3, 11)	0.020
Median fibrinogen (g/l)	2.90 (2.44, 3.33)	3.34 (2.62, 3.92)	0.013
Median leucocyte (×10^9/l)	7.8 (6.5, 10.1)	8.8 (6.9, 11.3)	0.040

*Twice the upper limit of the authors' laboratory.

Table 2 Cause of death

Cause of death	Number
Total cardiovascular mortality	18 (21.7%)
In-hospital mortality	9 (10.8%)
Congestive heart failure	7
Acute, fulminating pulmonary oedema within 24 hours of admission (severe MR)	2
Acute, fulminating pulmonary oedema > 24 hours after admission (severe MR)	1
Hypotension and cardiogenic shock	2
Cardiorrhexis	2
Arrhythmias	1
Reinfarction	1
Mortality after discharge	9 (10.8%)
Congestive heart failure	4
Reinfarction	2
Sudden death	2
Aortic aneurysm rupture	1

MR, mitral regurgitation.
Cardiorrhexis was defined as sudden death with electromechanical dissociation.

Table 3 Clinical data of surviving and non-surviving diabetic patients

	Surviving (n = 65)	Non-surviving (n = 18)	p Value
Median age (years)	69	76	0.001
Female sex	16 (24.6%)	10 (55.6%)	0.012
Hypertension	31 (47.7%)	8 (44.4%)	0.807
Smoking history	24 (36.9%)	3 (16.7%)	0.105
Hypercholesterolaemia	32 (49.2%)	11 (61.1%)	0.372
Body mass index ⩾ 25 kg/m^2	43 (66.2%)	9 (50.0%)	0.210
Stable angina > 3 months before admission	22 (33.8%)	9 (50.0%)	0.210
Previous myocardial infarction	18 (27.7%)	6 (33.3%)	0.640
Aspirin at admission	20 (30.8%)	6 (33.3%)	0.640
Statins at admission	13 (20.0%)	0	0.039
⩾2 anginal episodes in previous 24 hours	22 (33.8%)	6 (33.3%)	0.968
ST segment depression ⩾0.5 mm at admission	32 (49.2%)	14 (77.8%)	0.031
Troponin I ⩾0.2 ng/ml at admission*	20 (30.8%)	9 (50.0%)	0.130
Median C reactive protein (mg/l)	6 (3, 9)	13 (7, 39)	0.001
Median fibrinogen (g/l)	3.05 (2.51, 3.80)	3.95 (3.55, 4.65)	<0.001
Median leucocyte count (10^9/l)	8.4 (6.7, 10.3)	11.4 (8.7, 12.9)	0.005

*Twice the upper limit of the authors' laboratory.

C reactive protein concentration (p = 0.453), fibrinogen concentration (p = 0.126), or leucocyte count (p = 0.548). No association was found between concentrations of the three inflammatory markers or with lesion morphology.

Table 4 shows the incidence of clinical events according to tertiles in which diabetic patients were divided on the basis of their C reactive protein and fibrinogen concentration and their leucocyte counts at admission. The Kaplan-Meier analysis

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Table 4 Incidence of cardiovascular death and events during hospitalisation and follow up

		Tertile 1	Tertile 2	Tertile 3	p Value
C reactive protein	Range (mg/l)	<5	5–8	>8	
	Number	28	26	29	
	Follow up mortality	1 (3.6%)	5 (19.2%)	12 (41.4%)	0.002
	In-hospital mortality	1 (3.6%)	1 (3.8%)	7 (24.1%)	0.017
	Follow up revascularisation	5 (17.4%)	10 (38.5%)	6 (20.7%)	0.171
	In-hospital revascularisation	3 (10.7%)	2 (7.7%)	2 (6.9%)	0.863
	Follow up reinfarction	3 (10.%7)	3 (11.5%)	5 (17.2%)	0.733
Fibrinogen	Range (g/l)	<2.81	2.81–2.78	>2.78	
	Number	28	27	28	
	Follow up mortality	1 (3.6%)	6 (22.2%)	11 (39.3%)	0.005
	In-hospital mortality	0	3 (11.1%)	6 (21.4%)	0.036
	Follow up revascularisation	8 (28.6%)	9 (33.3%)	4 (14.3%)	0.096
	In-hospital revascularisation	5 (17.9%)	1 (3.7%)	1 (3.6%)	0.088
	Follow up reinfarction	5 (17.9%)	1 (3.7%)	5 (17.9%)	0.205
Leucocyte count	Range ($\times 10^9$/l)	<7.5	7.6–10.2	>10.3	
	Number	29	26	28	
	Follow up mortality	4 (13.8%)	3 (11.5%)	11 (39.3%)	0.0214
	In-hospital mortality	2 (6.9%)	0	7 (25.0%)	0.009
	Follow up revascularisation	10 (34.5%)	7 (26.9%)	4 (14.3%)	0.807
	In-hospital revascularisation	5 (17.2%)	2 (7.7%)	0	0.064
	Follow up reinfarction	4 (13.8%)	2 (7.7%)	5 (17.9%)	0.543

showed that patients with the highest C reactive protein and fibrinogen concentrations and leucocyte count had a significantly higher probability of death from cardiac causes during the entire follow up period than patients with lower values (fig 1).

Multivariable analysis of the relations between clinical data, myocardial damage markers, findings on the ECG, serum inflammatory markers determined, and the risk of cardiovascular death showed that two variables were significant for in-hospital mortality (C reactive protein concentrations and leucocyte count at admission) and four variables for the entire follow up period (C reactive protein, fibrinogen, leucocyte count, and female sex). The adjusted odds ratios for in-hospital mortality were 9.19 (95% CI 1.60 to 52.74; p = 0.013) for diabetic patients with C reactive protein in the top third of measurements and for leucocyte count 9.79 (95% CI 1.71 to 56.04; p = 0.010). The hazard ratios for death during the entire follow up were 4.51 (95% CI 1.62 to 12.55; p = 0.004) for diabetic patients in the highest tertile of C reactive protein, 3.74 (95% CI 1.32 to 10.62; p = 0.013) for patients in the highest tertile of fibrinogen, and 3.64 (95% CI 1.37 to 9.68; p = 0.01) for leucocyte count. Finally, the hazard ratio for female sex diabetic patients was 3.45 (95% CI 1.30 to 9.09; p = 0.013).

Categorising patients on the basis of the number of increased inflammatory markers on admission, 43.5% had no increased markers, 37.3% had one, 12% had two, and 7.2% had increases in all three. Fig 2 shows adjusted hazard ratios for cardiovascular death in diabetic patients stratified by the number of increased inflammatory markers.

DISCUSSION

Coronary tissue from diabetic patients with acute coronary syndrome has more lipid rich atheroma, thrombosis, and macrophage cell infiltration than tissue from patients without diabetes. This higher incidence of inflammatory cell infiltration in coronary tissue from diabetic patients suggests not only that inflammation may play an important part in the pathophysiology of acute coronary syndrome but also that a more proinflammatory state is present in diabetic than in non-diabetic patients. The observation of increased concentrations of C reactive protein and other acute phase reactants in diabetes is not new; reports date back to the 1980s. Among > 16 000 patients in the NHANES III (national health and nutrition examination survey III), C reactive protein was shown to be higher in patients with diabetes or glucose intolerance than in control participants.[33 34] In consideration of the overlap between inflammatory status and diabetes, some authors have also looked at the association between these two conditions among patients with acute coronary syndrome. In the FRISC (Fragmin during instability in coronary artery disease) study diabetes and C reactive protein concentrations on admission were shown to be independent predictors of long term outcome.[23] Interestingly, in some series the presence of diabetes has been associated, independent of the prognosis, with increased C reactive protein concentrations,[24 25] whereas in other studies the two parameters appeared to be independent.[26] In our study diabetic patients with acute coronary disease had an enhanced underlying inflammatory reaction, as their C reactive protein concentrations, fibrinogen concentrations, and leucocyte counts at admission were higher than in non-diabetics. Myocardial necrosis may account for some of the increase found in C reactive protein, fibrinogen, and leucocytes. However, troponin I concentrations were similar at admission in both groups and the correlations between troponin I and C reactive protein, fibrinogen, or leucocytes in diabetic patients were also weak, as previous studies of non-diabetic patients have shown.[23 27]

Diabetic patients who suffer a myocardial infarction have a high mortality both acutely and on long term follow up. This increased in-hospital mortality among diabetic patients with acute coronary syndromes is attributable predominantly to a higher increased incidence of reinfarction and recurrent ischaemia, and mainly to congestive heart failure.[35–37] Furthermore, cardiogenic shock is more common and more severe in diabetic patients than would be expected from the size of the index infarction.[38] Despite the size of the infarction, pre-existing diastolic dysfunction and reduced global and regional left ventricular ejection fraction of the non-infarcted myocardium[39 40] are major culprits of the congestive symptoms. Late mortality is principally related to recurrent myocardial infarction and the development of new congestive heart failure.[36 38] We also found that congestive heart failure was the main contributing factor not only of in-hospital mortality (78%) but also of late mortality (44%). Our finding of enhanced inflammatory response may explain the higher mortality found in diabetic patients after unstable coronary disease and may help future treatments—glycoprotein IIb/IIIa inhibitor, aspirin, and some cholesterol lowering drugs exert a beneficial influence on inflammation markers and clinical outcomes.[41]

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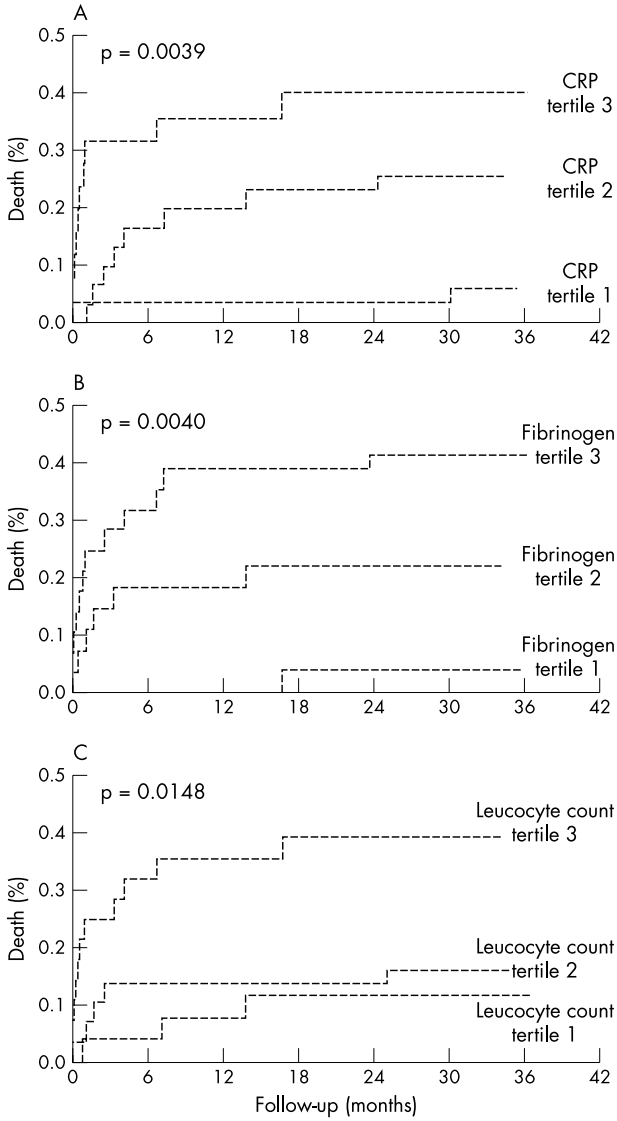

Figure 1 Kaplan-Meier survival estimates for diabetic patients divided into tertiles according to (A) C reactive protein concentrations, (B) fibrinogen concentrations, and (C) leucocyte count on admission.

A variety of clinical studies have been carried out to investigate different markers of inflammation as predictors of coronary events in patients with unstable angina and after myocardial infarction. Although several of them have been shown to predict risk independently of conventional risk factors, the question remains which marker should be preferred in the routine clinical setting. To our knowledge very limited information is available concerning diabetic patients, although one of the goals of this study was to evaluate and compare the usefulness of C reactive protein concentration, fibrinogen concentration, and leucocyte count as predictors of death in diabetic patients. The association between these serum inflammatory markers in diabetic patients and the risk of death was independent of the presence or absence of other classical risk factors: troponin I concentration, electrocardiographic changes, prior treatment with aspirin or statins, and other known predictors of the risk of death. Leucocyte count and C reactive protein concentration were strong and similar predictors of in-hospital mortality in our study, and both were superior to fibrinogen concentration. C reactive protein developed as the most significant predicting factor of cardiovascular death in the entire follow up. As leucocyte count is widely assessed in patients admitted with acute coronary syndrome we must not forget that it may provide clinicians with a simple tool for risk stratification. In our opinion, our data suggest that at admission C reactive protein concentration should be routinely determined in the initial evaluation of diabetic patients admitted with acute coronary syndrome. Simultaneous assessment of C reactive protein concentration, fibrinogen concentration, and leucocyte count also provides prognostic information and may have practical clinical applications in risk stratification and targeting of treatment of diabetic patients with unstable coronary disease. Moreover, categorising diabetic patients based on the number of increased inflammatory markers may counteract the intraindividual variability in the estimation of these inflammatory markers.[42]

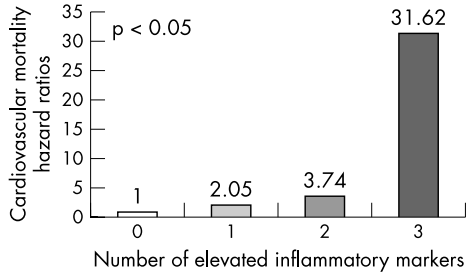

Figure 2 Cardiovascular death hazard ratios in diabetic patients based on the number of increased inflammatory markers.

Conclusions

Our study showed enhanced underlying inflammatory reaction in diabetic patients with acute coronary disease as shown by C reactive protein concentration, fibrinogen concentration, and leucocyte count on admission that were higher than those of non-diabetic patients. More interestingly, these markers of inflammation are independent predictors of cardiovascular death in diabetics with unstable non-ST elevation acute coronary syndrome.

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Authors' affiliations

P L Sanchez, J L Morinigo, P Pabon, F Martin, I Piedra, I F Palacios, C Martin-Luengo, Cardiac Unit, University Hospital, Salamanca, Spain

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Nurse initiated thrombolysis in the accident and emergency department: safe, accurate, and faster than fast track

S M Heath, R J I Bain, A Andrews, S Chida, S I Kitchen, M I Walters

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Objective: To reduce the time between arrival at hospital of a patient with acute myocardial infarction and administration of thrombolytic therapy (door to needle time) by the introduction of nurse initiated thrombolysis in the accident and emergency department.

Methods: Two acute chest pain nurse specialists (ACPNS) based in A&E for 62.5 hours of the week were responsible for initiating thrombolysis in the A&E department. The service reverts to a "fast track" system outside of these hours, with the on call medical team prescribing thrombolysis on the coronary care unit. Prospectively gathered data were analysed for a nine month period and a head to head comparison made between the mean and median door to needle times for both systems of thrombolysis delivery.

Results: Data from 91 patients were analysed; 43 (47%) were thrombolysed in A&E by the ACPNS and 48 (53%) were thrombolysed in the coronary care unit by the on call medical team. The ACPNS achieved a median door to needle time of 23 minutes (IQR = 17 to 32) compared with 56 minutes (IQR = 34 to 79.5) for the fast track. The proportion of patients thrombolysed in 30 minutes by the ACPNS and fast track system was 72% (31 of 43) and 21% (10 of 48) respectively (difference = 51%, 95% confidence intervals 34% to 69%, $p<0.05$).

Conclusion: Diagnosis of acute myocardial infarction and administration of thrombolysis by experienced cardiology nurses in A&E is a safe and effective strategy for reducing door to needle times, even when compared with a conventional fast track system.

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