Prediction of spontaneous coronary reperfusion in myocardial infarction

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Summary: To investigate the possibility of predicting the occurrence of spontaneous coronary reperfusion in acute myocardial infarction we studied 91 patients in a randomized trial on the clinical efficacy of intracoronary streptokinase compared to conventional treatment. Of the 46 patients treated conventionally 40 had catheterization 6 weeks after the infarction. Spontaneous coronary reperfusion was found in 19 patients (48%). The time to peak CK-MB in these patients was considerably longer than in patients with streptokinase-induced coronary reperfusion and similar to the time in patients without spontaneous coronary reperfusion. Spontaneous coronary reperfusion was associated with a relative improvement of radionuclide ejection fraction from day 1 to day 14 after admission. There was no difference in the occurrence of ventricular arrhythmia or recurrent ischaemic events between the patients with and those without spontaneous coronary reperfusion.

Thus, spontaneous coronary reperfusion is not uncommon in traditionally treated myocardial infarction, but its occurrence cannot be predicted by enzymatic or clinical parameters.

Introduction

In most cases of acute myocardial transmural infarction proximal thrombotic occlusion of a major coronary artery is found (DeWood *et al.*, 1980). Intracoronary or intravenous thrombolytic therapy has been shown to be effective in reperfusing occluded coronary arteries (Kahja *et al.*, 1983; Kennedy *et al.*, 1983; Anderson *et al.*, 1984; Rentrop *et al.*, 1983; 1984; Simoons *et al.*, 1985). Spontaneous coronary reperfusion has been observed in about 10% of patients with acute transmural myocardial infarction undergoing coronary angiography within 6 hours after onset of symptoms (Smalling *et al.*, 1983; Rentrop *et al.*, 1984; Anderson *et al.*, 1984; Simoons *et al.*, 1985). On coronary angiography in the chronic phase of myocardial infarction spontaneous coronary reperfusion is seen in up to 40% of cases (DeFeyter *et al.*, 1983; Verheugt *et al.*, 1984).

As there are indications that spontaneous coronary reperfusion leads to preservation of left ventricular function (DeFeyter *et al.*, 1983) it would be of interest to be able to predict spontaneous coronary reperfusion.

Streptokinase-induced coronary reperfusion in acute myocardial infarction results in rapid myocardial enzyme washout (Blanke *et al.*, 1984). Some investigators have used this laboratory finding as an indicator of spontaneous coronary reperfusion without angiographic proof afterwards (Ong *et al.*, 1983).

The purpose of this study was to assess the value of clinical and laboratory parameters in the prediction of spontaneous coronary reperfusion in acute myocardial infarction. Therefore we studied a well documented group of patients with acute myocardial infarction undergoing standard treatment and compared it with a group of patients who had intracoronary streptokinase intervention during the acute stage of their infarction.

Patients and methods

Ninety-one patients were randomized to study the effect of intracoronary streptokinase in comparison with conventional treatment. The patients participated in a larger randomized trial, of which the methods and results are published in detail elsewhere (Simoons *et al.*, 1985). Patients allocated to conventional treatment were treated with subcutaneous heparin 10,000 U per 24 hours and simultaneously with coumadin. When the partial thromboplastin

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time exceeded 120 seconds, heparin was discontinued. At discharge, usually within 14 days after admission, coumadin was discontinued as well.

In all patients blood samples for routine analysis were taken at 0, 3, 6, 12, 18, 24, 36 and 48 hours after randomization. Radionuclide ventriculography was performed in all patients within 48 hours after randomization and at discharge in the surviving patients. Within 6 weeks after discharge coronary angiography and left ventricular angiography was planned in all patients.

Forty six patients were allocated to conventional and 45 patients to intracoronary streptokinase treatment.

Of the 46 patients allocated to conventional treatment 6 did not undergo angiography at 6 weeks because of death in 3 and refusal in 3. The remaining 40 patients were studied for the prediction of spontaneous coronary reperfusion in acute myocardial infarction (group A). Of the 45 patients allocated to streptokinase treatment 9 did not undergo acute coronary angiography because of refusal (6 patients), peripheral vascular occlusion (2 patients) and longstanding cardiac massage after randomization in one patient. Of the 36 remaining patients 9 (25%) had an unsuccessful fibrinolytic procedure. Together with the remaining 27 patients they were used as the reference group for the presence or absence of acute coronary reperfusion (group B).

Results

In group A spontaneous coronary reperfusion was observed in 19 patients (49%). The relation between time to peak CK-MB and the occurrence of coronary reperfusion in groups A and B is given in Table I. Streptokinase-induced reperfusion results in an early enzyme peak, whilst spontaneous coronary reperfusion does not. Unsuccessful streptokinase intervention shows a similar late enzyme peak.

Changes in radionuclide left ventricular ejection fraction in group A are presented in Table II. Spontan-

eous coronary reperfusion seems to be correlated with an improvement of left ventricular function.

Table III shows the occurrence of early (< 48 hours after admission, late (> 48 hours after admission) ventricular fibrillation or sustained ventricular tachycardia and recurrent ischaemic events (angina or myocardial infarction in the same region) before angiography at 6 weeks in group A. There are no significant differences in the occurrence of ventricular arrhythmia or recurrent ischaemia between patients with and those without an occluded infarct related coronary artery.

Discussion

Spontaneous coronary reperfusion is not an uncommon finding in myocardial infarction. We found an incidence of 48%. In patients with spontaneous coronary reperfusion left ventricular function is better (DeFeyer *et al.*, 1983), though the mechanism of this phenomenon is unclear. It would be useful to be able to predict the occurrence of spontaneous reperfusion.

In this study we confirmed the observation of better left ventricular function in patients showing an open infarct related vessel at late angiography. However, neither clinical nor laboratory data during the evolution of the infarction reflect the presence or absence of spontaneous coronary reperfusion. Therefore, extreme caution is necessary in the interpretation of studies dealing with reperfusion in acute myocardial infarction without coronary angiography afterwards (Ong *et al.*, 1983).

We used streptokinase-induced early reperfusion as a reference for the laboratory parameters of coronary reperfusion. It is possible that intracoronary streptokinase by itself could alter myocardial enzyme washout. However, we found that patients with an unsuccessful intervention show a late peak, as observed previously (Schwarz *et al.*, 1984). So, early enzyme peaks are reperfusion dependent and not drug dependent.

These data indicate that spontaneous coronary reperfusion seems to occur rather late in the course of

Table I Myocardial enzyme release pattern in both groups

	Group A		Group B	
	Spontaneous reperfusion	No spontaneous reperfusion	Streptokinase-induced reperfusion	No streptokinase-induced reperfusion
Number of patients	19	21	27	9
Time to peak CK-MB (hours)	17.4 ± 5.7*	18.2 ± 5.4	8.7 ± 3.1	15.6 ± 3.2

* $P < 0.0001$ vs streptokinase-induced reperfusion.

Table II Radionuclide left ventricular ejection fraction in group A

	Spontaneous reperfusion	No spontaneous reperfusion
Number of patients	19	21
LVEF on day 1	0.40 ± 0.12	0.41 ± 0.09
LVEF on day 14	0.45 ± 0.11	0.39 ± 0.12
Δ LVEF (%)	+ 15.0 ± 8.9*	- 4.8 ± 29.4

* $P < 0.05$

LVEF = left ventricular ejection fraction

Δ LVEF = $\frac{\text{LVEF day 1} - \text{LVEF day 14}}{\text{LVEF day 1}}$

LVEF day 1

myocardial infarction without clinical manifestations. If reperfusion occurs late, preservation of left ventricular function becomes less likely. The results of this study do not offer an explanation for the preservation of left ventricular function in relation to a patent infarct-related coronary artery. There must be factors

Table III Clinical events in group A

	Spontaneous reperfusion	No spontaneous reperfusion
Number of patients	19	21
Early VT/VF	6 (33%)	11 (52%)
Late VT/VF	2 (11%)	2 (10%)
Recurrent angina	2 (11%)	1 (5%)
Recurrent infarction	1 (5%)	1 (5%)

VT/VF = Ventricular tachycardia/fibrillation.

other than reperfusion alone, that lead to salvage of myocardium in the course of myocardial infarction. Moreover these factors cannot be identified by laboratory or clinical parameters during the acute phase of myocardial infarction.

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