EVALUATION OF THE EFFECT OF INTRAVENOUS STREPTOKINASE ON MYOCARDIAL INFARCT SIZE BY USING THE QRS SCORING SYSTEM

(Received 25 April 1991)

A. Oğuz, M.D.* / R. Erkoç, M.D.* / S. Ersanlı, M.D.*

* *Specialist, Social Security Göztepe Hospital, IIIrd Clinic of Internal Medicine, Istanbul, Turkey.*

SUMMARY

This study evaluated the effect of intravenous streptokinase therapy on myocardial infarct size retrospectively. For estimating myocardial infarct size we used an electrocardiographic QRS scoring system. The study included 60 patients with acute myocardial infarction admitted within the initial 6 hours. Thirty patients received intravenous streptokinase while the other 30 clinically matched patients constituted the control group. The QRS score of each patient was computed from an electrocardiogram obtained on the day of discharge. The mean QRS score of streptokinase treated group was significantly lower than control group (5.73±0.50 vs 7.30±0.50; $p<0.05$). This significant difference was consistent both in the anterior and inferior myocardial infarctions ($p<0.05$). These findings demonstrate that intravenous streptokinase therapy is effective on limiting infarct size when given at the early stages of acute myocardial infarction.

Key words: Streptokinase, Acute myocardial infarction, QRS scoring system.

INTRODUCTION

The short-term and long term prognosis after myocardial infarction is related to the amount of myocardium damaged and thus to the extent of left ventricular dysfunction(1). The most effective way to limit myocardial necrosis in evolving myocardial infarction may be early restoration of coronary blood flow(2). Coronary reperfusion in patients with an evolving myocardial infarction may be induced by mechanical or pharmacologic intervention(3, 4). Pharmacologic thrombolysis appears to be the most practical method of lysing coronary thrombi, allowing early reperfusion after an acute myocardial infarction without the need for a cardiac catheterization laboratory or higly specialized personnel.

In this study we examined whether intravenous streptokinase treatment reduced the infarct size as assessed electrocardiographically by using a QRS scoring system.

METHODS

Sixty patients admitted to the coronary care unit with the diagnosis of acute myocardial infarction were evaluated retrospectively. A standard acute myocardial infarction therapy protocol including aspirin and sublingual nitroglycerin was applied to all patients. No B-blocker was used during the first 24 hours. Intravenous nitroglycerin was used in 5 patients with persistant ischemic chest pain in the streptokinase group and in 6 patients in the control group ($p>0.05$). After the first 24 hours 6 patients in the streptokinase group and 4 patients in the control group received B-bloker therapy for recurrant ischemic chest pain ($p>0.05$). Thirty of the cases had received thrombolytic therapy. Thirty patients with similar clinical parameters admitted before we have started to use streptokinase were chosen as the control group.

Inclusion criteria for thrombolytic therapy for patients at risk of acute transmural myocardial infarction were; 1) Age younger than 70 years; 2) ST-segment elevation ≥0.1 mV in 2 of 3 inferior leads, 2 contiguous precordial leads, or leads I and aVL that was unresponsive to nitroglycerin; 3) 30 minutes of myocardial ischemic pain (not reversed by sublingual nitroglycerin) and 4) Less than 6 hours elapsed time from the onset of ischemic pain to thrombolytic therapy.

The criteria for patient exclusion were; 1) Uncontrolled hypertension (systolic pressure >180 mmHg or diastolic pressure >110 mmHg); 2) The presence of contraindications to streptokinase administration such as a history of gastrointestinal bleeding, cerebrovascular accident, bleeding tendency, recent surgery, or antecedent resuscitation; 3) The presence of malignant tumors or terminal noncardiac illness.

Thrombolytic Therapy Protocol

Before the initiation of therapy, blood samples were drawn for a complete blood count, prothrombin time, clotting time, total creatine kinase. A 12 lead electrocardiogram was recorded. Each patient recieved a 40 mg bolus of methyl prednisolone and 50 mg bolus of phenyramine intravenously followed by

1.500.000 units of intravenous streptokinase in 200 ml of 5 per cent dextrose in water over a period of 1 hour. The infusion of streptokinase was followed by intravenous heparin 5.000 units every 4 hours for 5 days. On the third day, oral anticoagulation was started with warfarin 5 mg/d and continued according to prothrombin time controls until discharge.

QRS Score

The QRS score of each patient was computed from an electrocardiogram obtained on the day of discharge. The duration and amplitude of each deflection in the QRS complex were measured for 10 of the standard 12 leads (I, II, aVL, aVF, and V_{1-6}). QRS duration measurements (milliseconds) were made horizontally along the PR-segment baseline. Amplitude measurements (millivolts) were made vertically from this baseline even when the ST-segment was shifted. From these manual measurements, a point score for each electrocardiogram was determined from weighted criteria which were developed by Selvester et al(5) and modified by Hindman et al(6) (Table I).

Statistical Analysis

Averaged data are generally presented as mean ± SEM. The comparison of two groups were made by using chi-square, chi-square Yates and Student's t tests where appropriate. Non-parametric comparison of subgroup mean QRS scores were analysed by using Mann-Whitney U test.

RESULTS

The patient characteristics are summarised in table II. The two groups were comparable with respect to age, sex, Killip class at entry and location of infarct as well as with regard to history of previous myocardial infarction, blood pressure and heart rate.

The mean QRS score was significantly lower in the streptokinase group (5.73 ± 0.50) than the control group (7.30 + 0.50) ($p<0.05$). For both anterior and inferior subgroups in the streptokinase group the QRS scores were also significantly lower (6.74 ± 0.62 and 4.0 ± 0.54 respectively) than the control group (8.85 ± 0.80 and 6.12 ± 0.48 respectively) ($p<0.05$).

Bleeding, hypotension and allergic reactions were observed as the side effects of streptokinase treatment. One patient had hematoma at the gluteal region due to intramuscular injection and required blood transfusions and four had minor bleeding events. No bleeding complication was observed in the control group. Four patients had hypotension during streptokinase infusion, whereas one patient in the control group had transient hypotension in the first hour of hospitalization. Maculopapular skin rashes were observed in two patients treated with streptokinase. No such reactions were present in the control group. There was no in-hospital mortality in the streptokinase group.

DISCUSSION

Successful reperfusion with intravenous infusion of streptokinase has led to apparent myocardial salvage and improvement in left ventricular function. In a study by Schröder and coworkers(7), improvement in contractility, indicated by an increase in regional segment shortening, was achieved. Thrombolytic therapy also appeared to reduce the infarct size, calculated from the left ventriculogram. The Intravenous Streptokinase in Acute Myocardial infarction (ISAM) study(8) reported higher global and regional ejection fractions and smaller infarct size as estimated by creatine kinase MB data in the streptokinase treated group. In the Thrombolysis in Myocardial Infarction (TIMI) Phase I trial, regional wall motion in the infarct site, as measured by centerline method, was improved by streptokinase treatment(9).

Although there are many methods to estimate infarct size such as left ventriculography, radionuclide imaging, serial creatine kinase -MB measurements, each has disadvantages. These include a time delay before the test becomes positive, a limit in the number of times that a test can be repeated, the need for expensive equipment that is not generally available and inability to estimate the size of both acute and remote infarcts.

The electrocardiogram is almost universally available, easily acquired, repeatable, inexpensive and noninvasive. The QRS scoring system is a method for estimating the amount of myocardial damage by using standard 12 lead electrocardiogram. Points of QRS score are accumulated from Q- and R- wave durations, R- and S- wave amplitudes, R/Q or R/S amplitude ratios and the presence of R-wave notching, with each point representing approximately 3 per cent of the left ventricle. With 5 consecutive multicenter studies (6, 10-13), correlation between anatomical infarct size and QRS score was well demonstrated.

In this study the 54-criteria 32-points QRS scoring system was used for estimating the efficacy of intravenous streptokinase treatment in acute myocardial infarction. The results showed that the QRS score of the streptokinase treated group was significantly lower than the control group ($p<0.05$). Thus it may be said that the infarct size of streptokinase treated group was smaller than the control group.

Hogg KJ et al(14) reported that the QRS score of thrombolytic treatment group was significantly lower than the control group in their study. Using both left ventricular angiography and a QRS scoring system that estimated left ventricular function and the size of myocardial infarction, Koren et al(15) have found that greater salvage of myocardium is possible when intravenous streptokinase is administered early. They found a negative correlation between the ejection fraction and the QRS score thus the higher the QRS score, the greater the impairment of left ventricular function.

In conclusion this study suggests that intravenous streptokinase treatment at early stages of myocardial infarction can limit ischemic myocardial damage demonstrated by using a QRS scoring system.

TABLE I Complete 54-Criteria / 32-Point QRS Scoring System.

Lead	Max Lead Points	Criteria	Pts
I	(2)	Q≥30 ms	(1)
		R/Q≤1	(1)
		R≤0.2 mV	(1)
II	(2)	Q≥40 ms	(2)
		Q≥30 ms	(1)
aVL	(2)	Q≥30 ms	(1)
		R/Q≤ 1	(1)
aVF	(5)	Q≥50 ms	(3)
		Q≥40 ms	(2)
		Q≥30 ms	(1)
		R/Q≤1	(2)
		R/Q≤2	(1)

V_1				
Ant	(2)	Any Q		(1)
	Q or S ≥	1.8 mV		(1)
Post	(4)	R/S≥1		(1)
		R≥50 ms		(2)
		R≥1.0 mV		(2)
		R≥40 ms		(1)
		R≥0.6 mV		(1)
	Q and S ≤	0.3 mV		(1)

V_2			
Ant	(1)	Any Q	(1)
		R≤10 ms	(1)
		R≤0.1 mV	(1)
		R≤RV_1 mV	(1)
Post	(4)	R/S≥1.5	(1)
		R≥60 ms	(2)
		R≥2.0 mV	(2)
		R≥50 ms	(1)
		R≥1.5 mV	(1)
	Q and S ≤	0.4 mV	(1)

V_3 (1)	Any Q		(1)
	R≤20 ms		(1)
	R≤0.2 mV		(1)
V_4 (3)	Q≥20 ms		(1)
	R/S≤0.5		(2)
	R/Q≤0.5		(2)
	R/S≤1		(1)
	R/Q≤1		(1)
	R≤0.7 mV		(1)
	Notched R		(1)
V_5 (3)	Q≥30 ms		(1)
	R/S≤1		(2)
	R/Q≤1		(2)
	R/S≤2		(1)
	R/Q≤2		(1)
	R≤0.7 mV		(1)
	Notched R		(1)
V_6 (3)	Q≥30 ms		(1)
	R/S≤1		(2)
	R/Q≤1		(2)
	R/S≤3		(1)
	R/Q≤3		(1)
	R≤0.6 mV		(1)
	Notched R		(1)

Ant= anterior; Max= maximal; Post= posterior.

From Hindman NB, Schocken DD, Widmann M, et al. Evaluation of a QRS scoring system for estimating myocardial infarct size. V. Specificity and method of application of the complete system. Am J Cardiol. 1985; 55: 1485-1490.

TABLE II. Characteristics of the two groups of patients at entry.

Characteristic	Streptokinase Group	Control Group	P value
Mean age in years	52.0±1.56	55.9±1.95	NS
Male Sex	27	27	NS
KILLIP CLASS I	25	21	NS
KILLIP CLASS II	5	9	NS
Location of infarct			
Anterior	19	13	NS
Inferior	11	17	NS
Previous Infarction	9	5	NS
Admission vital signs :			
Blood Pressure (mm Hg)			
Systolic	128±5.6	129±8.2	NS
Diastolic	77±4.8	65±6.9	NS
Heart Rate (bpm)	84.3±15.4	79.9±4.5	NS

REFERENCES

1) *Sobel BE. Infarct size, prognosis and causal contiguity. Circulation 1976; 53: Suppl 1: 146-8.*

2) *Yusuf S, Phil D, Sleight P, et al. Routine medical management of acute myocardial infarction. Lessons from overviews of recent randomised trials. Circulation 1990; 82 (Suppl II): II-117-II-134.*

3) *DeWood MA, Spores J, Notske RN, et al. Medical and surgical management of myocardial infarction. Am J Cardiol 1979; 44: 1356-1364.*

4) *Holmes DR, Smith HC, Vliestra RE, et al. Percutaneous transluminal coronary angioplasty, alone or in combination with streptokinase therapy, during acute myocardial infarction. Mayo Clin Proc 1985; 60: 449-456.*

5) *Selvester RH, Wagner JO, Rubin HB. Quantitation of myocardial infarct size and location by electrocardiogram and vectorcardiogram. In: Snellin HA, ed. Boerhave Course in Quantitation in Cardiology. The Netherlands:Leyden University Press, 1972; 31-44.*

6) *Hindman NB, Schocken DD, Widmann M, et al. Evaluation of a QRS scoring system for estimating myocardial infarct size. V. Specificity and method of application of the complete system. Am J Cardiol 1985; 55: 1485-1490.*

7) *Schröder R, Biamino G, V Leitner ER, et al. Intravenous short,-term infusion of streptokinase in acute myocardial infarction. Circulation 1983; 67: 536-548.*

8) *The ISAM Study Group: A prospective trial of intravenous streptokinase in acute myocardial infarction (ISAM): Mortality and infarct size at 21 days. N Engl J Med 1986; 314: 1465-1471.*

9) *Sheenan FH, Braunwald E, Canner P, et al The effect of intravenous thrombolytic therapy on left ventricular function:A report on tissue-type plasminogen activator and streptokinase from the Thrombolysis in Myocardial Infarction (TIMI Phase I) trial. Circulation 1987; 75: 817-829.*

10) *Wagner GS, Freye CJ, Palmeri ST, et al. Evaluation of a QRS scoring system for estimating myocardial infarct size. I. Specificity and observer agreement. Circulation 1982; 65: 342-347.*

11) *Ideker RE, Wagner GS, Ruth WK, et al. Evaluation of a QRS scoring system for estimating myocardial infarct size. II. Correlation with quantitative anatomic findings for anterior infarcts. Am J Cardiol 1982; 49: 1604-1614.*

12) *Roark SF- Ideker RE, Wagner GS. Evaluation of a QRS scoring system for estimating myocardial infarct size. III. Correlation with quantitative anatomic findings for inferior infarcts. Am J Cardiol 1983; 51: 382-389.*

13) *Ward RM, White RD, Ideker RE. Evaluating of a QRS scoring system for estimating myocardial infarct size. IV. Correlation with quantitative anatomic findings for posterolateral infarcts. Am J Cardiol 1984; 53: 706-714.*

14) *Hogg KJ, Lees KR, Hornung RS, Howie CA, Dunn FG, Hillis NS. Electrocardiographic evidence of myocardial salvage after thrombolysis in acute myocardial infarction. Br Heart J 1989; 61: 489-495.*

15) *Koren G, Weiss AT, Hasin Y, et al. Prevention of myocardial damage in acute myocardial ischemia by early treatment with intravenous streptokinase. N Engl J Med. 1985; 313: 1384-9.*