Original paper

An analysis of coronarography results and selected cardiac risk factors in patients with acute coronary syndrome according to the level of cardiac troponin T

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Abstract

Introduction: There are many classical cardiac risk factors leading to acute coronary syndromes (ACS): arterial hypertension (HA), diabetes mellitus (DM), lipid disorders, family history (FH), smoking (Sm), obesity. The one of risk stratification is an evaluation of biochemical cardiac markers demonstrating myocardial injury.
Material and methods: The studied group included 124 patients (27% females, mean age 60.5±11.1 years) hospitalized with symptoms of ACS. In all patients the level of cardiac troponin T (cTnT) was measured in admission. In the case of a negative result a measurement was repeated after 6-12 hours. According to results the patients were stratified into: group 1 – with negative (<0.1 µg/L) and group 2 – with positive (≥0.1 µg/L) cTnT concentrations. In these groups results of coronarography and selected classical cardiac risk factors were analyzed.
Results: The performance of: HA, Sm, FH, obesity and lipid profile was similar. The percentage of critical single and multivessel coronary stenoses did not differentiate both groups. In patients with a positive cTnT in comparison to the cTnT negative group diabetes, and the critical stenoses of the circumflex coronary artery ($p<0.05$) occurred more often. In diabetics with the positive cTnT compared to non-diabetics of group 2 frequently the elevated concentration of triglycerides ($p<0.01$) and the overweight in comparison to diabetics of the 1 group ($p<0.05$) were documented.
Conclusions: In patients with acute coronary syndrome and a positive cTnT diabetes occurs more often compared to the cTnT negative patients. Diabetics belong to the group of high risk, so they require a detailed diagnosis and treatment.

Key words: cardiac risk factors, acute coronary syndrome (ACS), coronarography, cardiac troponin T (cTnT), diabetes (DM).

Introduction

The cardiac troponins T and I (cTnT, cTnI) determinations are the standard procedure in the diagnosis of acute coronary syndromes (ACS) and they are useful as a basal test in a myocardial lesion evaluation. The correlation between cTnT levels and clinical course of ACS is known very well, so it allows a risk stratification and short- and long-term prognosis in these patients. A fatal course of ACS in patients with an elevated cTnT concentration was described many times. It is manifested as: a recurrent ischemic episode, cardiac death and the necessity of interventional procedures, including surgical [1, 2].

In the literature there are only few data about cardiac risk factors and coronarography results in patients with ACS in correlation with a cTnT level. So the aim of our study was to evaluate the selected cardiac risk factors and the advanced atheromatous changes in coronary arteries in patients with symptoms of ACS according to the cTnT concentration.

Material and methods

The studied group included 124 patients (27% females, aged 29-81, mean age 60.5±11.1 years) hospitalized from March of 2003 to March of 2004 with symptoms of ACS. In all patients the level of cTnT in admission was measured, using the Cardiac T Quantitative Rapid Assay by Roche, based on the dual monoclonal antibody "sandwich" principle. The samples were obtained from venous whole blood. In case of a negative result measurement was repeated after 6-12 hours. According to the results patients were stratified into two groups (Table I): group 1 included 63 patients (33% females, aged 39-79 years; mean age 61.6±10.5 years), with a negative cTnT (the level <0.1 µg/L) and group 2 included 61 patients (21% females, aged 29-81 years; mean age 59.3±11.8 years), with a positive-elevated cTnT (the level ≥0.1 µg/L).

From all patients the history data were obtained, including: anamnesis of coronary artery disease (CAD), previous revascularization (percutaneous coronary intevention-PCI or coronary artery bypass graft-CABG), duration of stenocardial pain, family history (FH), arterial hypertension (HA), diabetes mellitus (DM) and smoking (Sm). Lipid disorders with the atherogenous index and overweight or obesity were also analyzed. An uncorrect weight was estimated using the body mass index: BMI=[weight (kg)/height (m)^2]. An overweight was defined as BMI ≥25 kg/m^2 and the obesity – with BMI ≥30 kg/m^2. An atherogenous index, described as a quotient of LDL (low density lipoprotein cholesterol) and HDL (high density lipoprotein cholesterol) – LDL/HDL was estimated. The correct values should be: <4 in persons without cardiac risk factors, <3 in the case of these risk factors presence and <2 in patients with a documented CAD [3]. In all patients coronarography was performed. The following critical atheromatous changes, according to the American Heart Association/American College of Cardiology [4], were analyzed in the left main coronary artery-LMC (≥50%) and main coronary arteries (≥75%) – the left anterior descending artery (LAD), the circumflex artery (Cx) and the right coronary artery (RCA). The course of qualification for coronorography was also determined (urgent or planned).

For all parameters the arithmetical mean with a standard deviation ($\bar{\chi}$SD) was accounted. The statistic importance was estimated by the t-Student's test and Cochran-Cox test, single and multivariable analysis using the logistic regression and qasi-Newton method. Differences were recognized as statistically important at $p<0.05$. The studies were made basing on rules of the local Ethics Commission. All patients agreed to take part in the study.

Results

The studied groups did not differ in parameters describing: age, sex, but males were statistically more often (Table I), duration of CAD, the previous myocardial infarction (MI), duration of stenocardia and coronary artery revascularization (PCI/CABG) (Table II). The percentage of critical single and multivessel coronary stenoses was similar in both analyzed groups with the predominance of advanced multivessel changes (Table III). In patients with positive cTnT more often the critical atheromatous stenoses in the circumflex artery were found ($p<0.05$) (Table IV). The performance of: HA, Sm, FH (Table V), lipid disorders (Table VI) was similair in the analyzed groups of patients. But among females of the second group the levels of total and LDL cholesterol were significantly higher than in the group with negative cTnT (Table VI). Parameters describing an overweight or obesity did not differentiate both studied groups (Table VII). Based on the single variable analysis DM occured more often in patients with positive cTnT. The multivariable analysis did not document the statistic dependence between the estimated selected cardiac risk factors, results of coronarography and cTnT level ($p=0.2$). The degree of left ventricle lesion was quite similar in both groups. Left ventricle ejection fraction estimated in echocardiography was respectively 53±12.4% vs 50±10.9%.

Diabetic patients did not significantly differ in parameters like: age, sex, duration of CAD, ananesis of MI, duration of stenocardia and interventional procedures (PCI/CABG) (Table VIII). In all diabetics an urgent coronarography, independently of cTnT concentration, was performed, with the predominance of advanced multivessel coronary arteries stenoses (Table IX). There was no statistic difference in diabetic patients in both analyzed groups in the performance of: HA, Sm and FH (Table X). Among diabetics of the second group, in the lipid profile the triglycerides (TG) level was significantly higher, especially in men ($p<0.01$) than in the non-diabetics with positive cTnT (Table XI). In the same group the prevalence of overweight was also noted in comparison to diabetics of the first group, especially in females ($p<0.01$; Table XII).

Table I. Characteristics of studied groups of patients

	Group 1; n=63 DM/non-DM n=7/n=56	Group 2; n=61 DM/non-DM n=16/n=45
Mean age (years) DM/non-DM	61.6±10.5 68.3±9.9/60.7±10.3**	59.3±11.8 669±9.2/56.6±11.6**
Number of male [f] DM/non-DM	42 [0.67]** 4 [0.57]/38 [0.68]**	48 [0,79]** 12 [0.75]*/36 [0,8]**
Age of male (years) DM/non-DM	39-79 49-74/39-79	29-81 50-81/29-76
Mean age of male (years) DM/non-DM	61.1±10.6 66.5±11.9/60.6±10.4*	57.6±11.5 64.4±8.8/55.3±11.4*
Number of female [f] DM/non-DM	21 [0,33]** 3 [0.43]/18 [0.32]**	13 [0.21]** 4 [0.25]*/9 [0.2]**
Age of female (years) DM/non-DM	41-78 62-78/41-76	50-80 66-78/50-80
Mean age of female (years) DM/non-DM	62.5±9.4 70.7±8.1/61.1±10.4	65.8±11.2 74.5±5.7/61.9±11.1

**p<0.05, **p<0.001*
f – fraction
DM – diabetes mellitus

Table II. Characteristics of the anamnesis in studied groups of patients

	Group 1; n=63	Group 2; n=61	P
Duration of CAD (mean of weeks) *F/M*	7.9±10.3 *8.8±11.5/7.0±10.4*	6.4±9.3 *5.6±5.2/7.2±10.6*	>0.05 *>0.05*
Duration of stenocardia (mean of hours) *F/M*	5.1±3.2 *4.9±2.6/5.2±3.0*	4.8±3.9 *4.7±2.2/5.0±3.3*	>0.05 *>0.05*
MI in anamnesis [f] *F/M*	0.43 *0.48*/0.52**	0.47 *0.21*, **/0.79*,***	>0.05 **<0.05* ***<0.01*
PCI or CABG in anamnesis [f] *F/M*	0.28 0.39/0.61	0.16 0.3/0.7	>0.05 >0.05

F – female
M – male
CAD – coronary artery disease
MI – myocardial infarction
PCI – percutaneous coronary intervention
CABG – coronary artery bypass graft
f – fraction

Table III. Results of coronarography in studied groups of patients

	Group 1 [f]	Group 2 [f]	P
Urgent CORO *F/M*	0.65 *0.46*/0.54**	0.82 *0.2*, **/0.8*, ***	>0.05 **<0.05* ***<0.000*
Coronary arteries critical stenoses *F/M*	0.87 *0.36*/0.64**	0.95 *0.21**/0.79***	>0.05 **<0.01* ***<0.000*
Critical multivessel stenoses *F/M*	0.67# *0.43*/0.57**	0.72# *0.16*, **/0.84*, ***	>0.05 **<0.05* ***<0.000*
Critical single vessel stenoses *F/M*	0.20# *0.23*/0.77**	0.23# *0.36/0.64*	>0.05 **<0.05*
p	#<0.05	#<0.05	

CORO – coronarography
f – fraction
F – female
M – male

Table IV. Results of coronarography (critical stenoses) in studied groups of patients

	Group 1; n=63 DM/non-DM n=7/n=56 [f]	Group 2; n=61 DM/non-DM n=16/n=45 [f]	P
LAD DM/non-DM	0.68 0.71/0.68	0.70 0.69/0.71	>0.05 >0.05
Cx DM/non-DM	0.32* 0.43/0.3*	0.54* 0.63/0.51*	*<0.05 *<0.05
RCA DM/non-DM	0.54 0.57/0.54	0.62 0.75/0.58	>0.05 >0.05
LMC DM/non-DM	0.06 0.0/0.07	0.07 0.06/0.07	>0.05 >0.05

f – fraction
LMC – left main coronary artery
LAD – left anterior descending artery
Cx – circumflex artery
RCA – right coronary artery

Table V. The prevalence of HA, DM, Sm, BFH in the group of patients with ACS according to the level of cTnT

Cardiac risk factor	Group 1 [f]	Group 2 [f]	P
HA *F/M*	0.68 *0.44*/0.56*	0.72 *0.22*,**/0.77***	>0.05 **<0.05* ***<0.001*
DM *F/M*	0.11* *0.43/0.57*	0.27* *0.25*/0.75**	*<0.05 **<0.05*
Sm *F/M*	0.29 *0.22*/0.78**	0.39 *0.08**/0.92***	>0.05 **<0.01* ***<0.001*
FH *F/M*	0.35 *0.55/0.45*	0.37 *0.3*/0.7**	>0.05 **<0.05*

f – fraction
HA – arterial hypertension
DM – diabetes mellitus
Sm – smoking
FH – family history
F – female
M – male

Table VI. Lipid's concentrations (mmol/l) and atherogenous index (LDL/HDL) in the group of patients with ACS according to the level of cTnT

Lipid's concentration	Group 1; n=63	Group 2; n=61	P
TCH *F/M*	5.1±1.2 *4.8±1.2*/5.3±1.2*	5.4±1.3 *5.4±1.2*/5.4±1.3*	>0.05 **<0.05*
LDL *F/M*	2.9±0.9 *2.7±1.0*/3.1±0.8*	3.1±1.1 *3.2±1.2*/3.0±1.1*	>0.05 **<0.05*
HDL *F/M*	1.3±0.3 *1.4±0.3/1.2±0.2*	1.4±0.3 *1.5±0.4/1.3±0.2*	>0.05 *>0.05*
TG *F/M*	1.8±1.2 *1.7±0.9/1.9±1.3*	2.1±1.3 *1.8±0.7*/2.4±1.4**	>0.05 **<0.05*
LDL/HDL *F/M*	2.2±0.7 *1.9±0.6*/2.5±0.7**	2.2±1.1 *2.1±0.8/2.3±0.9*	>0.05 **<0.01*

TCH – total cholesterol
LDL – low density lipoprotein cholesterol
HDL – high density lipoprotein cholesterol
TG – triglycerides
LDL/HDL – atherogenous index
F – female
M – male

Table VII. The prevalence of the overweight and obesity [f] and the value of BMI in the group of patients with ACS according to the level of cTnT

	Group 1; n=63	Group 2; n=61	P
Overweight [f] *F/M*	0.44 *0.39/0.61*	0.42 *0.19*/0.81**	>0.05 **<0.01*
Obesity [f] *F/M*	0.24 *0.4/0.6*	0.26 *0.31/0.69*	>0.05 *>0.05*
BMI ±SD *F/M*	27.3±4.1 *26.8±4.9/27.6±3.6*	28.4±4.9 *28.8±4.6/28.3±5.0*	>0.05 *>0.05*

BMI ±SD – body mass index ± standard deviation
f – fraction
F – female
M – male

Table VIII. Characteristics of the anamnesis in the group of patients with DM vs non-DM

	Group 1		Group 2		P
	DM n=7	non-DM n=56	DM n=16	non-DM n=45	
Duration of CAD (mean of weeks) *F/M*	18.2±22.8 *19.7±27.6/17.1±23.0*	6.3±7.4 *7.0±6.4/5.9±7.9*	6.3±6.4 *8.6±7.0/5.6±6.3*	7.1±11.0 *4.1±3.8/7.8±11.7*	>0.05 *>0.05*
Duration of stenocardia (mean of hours) *F/M*	5.2±2.2 *4.8±1.6/5.3±2.7*	4.9±2.1 *4.7±2.2/5.0±3.3*	5.0±3.2 *4.9±3.2/5.1±2.1*	4.8±3.7 *4.6±2.6/4.9±3.4*	>0.05 *>0.05*
MI in anamnesis [f] F/M	0.7 0.6/0.4	0.4 0.45/0.55	0.3 0.2/0.8	0.5 0.2*/0.8*	>0.05 *<0.001
PCI or CABG in anamnesis [f] *F/M*	0.0 *0.0/0.0*	0.2 *0.3/0.7*	0.2 *0.3/0.7*	0.2 *0.15/0.85*	>0.05 *>0.05*

DM – diabetes mellitus
F – female
M – male
CAD – coronary artery disease
MI – myocardial infarction
PCI – percutaneous coronary intervention
CABG – coronary artery bypass graft
f – fraction

Table IX. Results of coronarography in the group of patients with DM vs non-DM (mean mmol/L/-SD)

	Group 1		Group 2		P
	DM n=7	non-DM n=56	DM n=16	non-DM n=45	
Urgent CORO *F/M*	1.0* *0.6/0.4*	0.6* *0.4/0.6*	1.0 *0.25*/0.75**	0.8* *0.2/0.8*	*<0.05 **<0.05*
Coronary arteries critical stenoses *F/M*	0.9 *0.3/0.7*	0.7* *0.2**/0.8***	1.0 *0.25*/0.75**	0.9* *0.2**/0.8***	*<0.05 **<0.05* ***<0.001*
Critical multivessel stenoses F/M	0.7 *0.2/0.8*	0.7## *0.45/0.55*	0.8# *0.2*/0.8**	0.7## *0.1**/0.9***	>0.05 **<0.05* ***<0.001*
Critical single vessel stenoses *F/M*	0.2 *1.0/0.0*	0.2## *0.2*/0.8**	0.2# *0.3/0.7*	0.2## *0.4/0.6*	>0.05 **<0.05*

#p<0.01, ## p<0.001
DM – diabetes mellitus
CORO – coronarography
f – fraction
F – female
M – male

Table X. The prevalence [f] of HA, Sm, FH in the group of patients with DM vs non-DM

Cardiac risk factor	Group 1 [f]		Group 2 [f]		P
	DM n=7	non-DM n=56	DM n=16	non-DM n=45	
HA *F/M*	1.0 *0.4/0.6*	0.7 *0.4/0.36*	1.0 *0.25*/0.75**	0.6 *0.2**/0.8***	>0.05 **<0.05* **<0.001*
Sm *F/M*	0.1 *0.0/1.0*	0.3 *0.2*/0.8**	0.3 *0.2/0.8*	0.4 *0.05**/0.95***	>0.05 **<0.01* ***<0.001*
FH *F/M*	0.6 *0.5/0.5*	0.3 *0.6/0.4*	0.2 *0.0/1.0*	0.4 *0.35/0.65*	>0.05 *>0.05*

DM – diabetes mellitus
f – fraction
HA – arterial hypertension
Sm – smoking
FH – family history
F – female
M – male

Table XI. Lipid's concentrations (mmol/l) and atherogenous index (LDL/HDL) in the group of patients with DM vs non-DM

Lipid's concentration	Group 1		Group 2		P
	DM n=7	non-DM n=56	DM n=16	non-DM n=45	
TCH *F/M*	5.4±1.2 *4.8±1.4/5.8±0.9*	5.1±1.2 *4.8±1.2*/5.2±1.2*	5.4±1.4 *4.9±0.7/5.6±1.6*	5.5±1.2 *6.0±1.3*/5.4±1.2*	>0.05 **<0.05*
LDL *F/M*	3.1±1.0 *2.5±0.8/3.5±1.0*	3.0±0.9 *2.7±1.1/3.1±0.9*	2.7±1.1 *2.7±0.4/2.7±1.2*	3.3±1.1 *3.9±1.3/3.2±1.0*	>0.05 *>0.05*
HDL *F/M*	1.3±0.2 *1.3±0.3/1.2±0.2*	1.3±0.3 *1.4±0.3/1.2±0.2*	1.4±0.2 *1.3±0.2/1.4±0.2*	1.3±0.3 *1.4±0.5/1.3±0.2*	>0.05 *>0.05*
TG *F/M*	2.1±0.6 *2.0±1.0/2.2±0.1*	1.8±1.2 *1.7±1.0/1.8±1.3*	2.9±1.6* *2.0±1.1/3.3±1.6***	1.8±1.0* *1.5±0.5/1.9±1.1***	*<0.05 ***<0.01*
LDL/HDL *F/M*	2.4±0.9 *1.9±0.4/2.9±1.0*	2.1±0.7* *1.9±0.6*/2.3±0.7**	2.0±0.8 *2.2±0.6/1.9±0.9**	2.5±1.1* *2.4±2.0/2.6±0.7**	*<0.05 **<0.05*

DM – diabetes mellitus
TCH – total cholesterol
LDL – low density lipoprotein cholesterol
HDL – high density lipoprotein cholesterol
TG – triglycerides
LDL/HDL – atherogenous index
F – female
M –male

Table XII. The prevalence of the overweight and obesity [f] and the value of BMI in the group of patients with DM vs non-DM

Cardiac risk factor	Group 1		Group 2		P
	DM n=7	non-DM n=56	DM n=16	non-DM n=45	
Overweight *F/M*	0.6* *0.25/0.75*	0.4 *0.4/0.6**	1.0* *0.75**/0.25***	0.4 *0.15**/0.85*,***	*<0.05 **<0.05* ***<0.01*
Obesity *F/M*	0.4 *1.0*/0.0*	0.2 *0.25*/0.75**	0.5 *0.25*/0.75*	0.2 *0.4/0.6*	>0.05 **<0.05*
BMI ±SD *F/M*	28.5±4.1 *31.3±2.1/25.8±3.9**	27.1±4.1 *26.0±4.9/27.8±3.6*	31.0±4.1* *30.3±5.1/31.2±4.0**	27.6±4.9* *28.1±4.6/27.4±5.0**	*<0.05 **<0.05*

DM – diabetes mellitus
BMI ±SD – body mass index ± standard deviation
f – fraction
F – female
M – male

Discussion

The pivotal meaning in the diagnosis of ACS refers to laboratory medicine, which determines biochemical markers, especially cTnT, in ischemic episodes of heart muscle [5]. Elevated cTnT level is initially an unfavourable prognostic factor worsening the clinical course and prognosis in patients with ACS in short- and long-term follow up [6, 7]. It was observed that in patients with a higher cTnT concentration and resting stenocardial pain the risk of cardiac death is increased 3-fold [8]. However in patients without resting complaints and with a correct electrocardiogram this risk increases 2-fold in related to patients with negative results of cTnT measurements [8]. It is essential that even a marginal cTnT elevation (0.01-0.09 µg/L) identifies a subgroup of high risk patients, in which a complicated ischemic episode can occur [9]. Unforunately, the limitation of our investigation was connected with a lack of the precise cTnT estimation under the cut off level characterizing MI (<0.1 µg/L). It is connected with the restriction of laboratory methods performing these measurements.

Our study refers to patients with many classical cardiac risk factors and advanced atheromatous process in the coronary arteries with a statistic majority of critical stenoses, especially multivessel in diabetic people. An analysis of selected risk factors has documented that DM is observed more often in patients with positive cTnT level. Diabetes is an excessively risk factor with a high prognostic usefulness. The possibility of death and recurrent ischemic episodes in these patients increases by a half [10, 11]. Among other adverse factors concomitant with DM in the literature there are: advanced age, family history related to premature CAD, smoking, MI in anamnesis and elevated cTnT [12]. Only advanced age and a higher cTnT concentrationts were confirmed in results of our investigations. It is most likely connected with the small number of diabetic patients. However, in these diabetic patients a higher TG concentrations and the overweight are more often observed. These parameters are components of a metabolic syndrome, which can lead to ACS.

Investigations performed by Torres et al. have showed, that DM and cTnT level ≥0.1 µg/L have an independent prognostic value for: heart failure, MI and death after ACS [13]. In these patients the prognosis during hospitalization can be improved by interventional procedures performed in 24 hours. The necessity of urgent coronarography in all diabetic patients, even independently of cTnT level, was documented in our study. But it is important to realize the possibility of recurrent ischemic episodes and recurrent revascularization in this high risk group of patients [14].

Last year's Timmer's et al. studies have showed that even a small dysglycemia increases the risk of ACS occurence [15]. Impaired fasting glucose (6.1-7.0 mmol/l) increases in-hospital mortality two-fold in patients with ACS [16]. Japanese scientists have observed that impaired glucose tolerance (IGT) is an impotrant risk factor for ACS in people without an earlier diagnosed DM. It was connected with advanced atheromatous changes confirmed in coronarography [17]. So in diagnostic management the oral glucose tolerance test (OGTT) can be useful in an erly IGT recognition.

Indirectly uncorrect LDL/HDL ratio can indicate apo B/apo A-I disorders. In our study elevated LDL/HDL values were statistically more often investigated in non-diabetic patients with a positive cTnT. A complete diagnosis using apo B and apo A-I determinations and their interdependence can be an important factor in prognosis evaluation in these patients.

An increased prevalence of DM in patients with a positive cTnT level focuses attention on people who are particularly in danger of a higher morbidity and mortality caused by ACS. It proves that in these groups of patients there is a need of a detailed diagnosis and suitable treatment. It is worth considering an intensive invasive therapy including drug eluting stents [18]. These people should undergo an intensive secondary prevention of probable recurrent ischemic episodes [19].

Conclusions

In patients with acute coronary syndrome and a positive cTnT diabetes occurs more often compared to the cTnT negative group. Diabetic patients belong to the group of high risk, so they require a detailed diagnosis and treatment.

Data collected during Individual Studies in the Department of Cardiology, 1st Chair of Cardiology and Cardiac Surgery in Lodz.

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