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# ASSOCIATION BETWEEN LABORATORY MARKERS AND PRESENCE OF CORONARY ARTERY DISEASE

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**The aim of this paper** is to elucidate the relation between laboratory markers and coronary artery disease (CAD).

**Methods**. The study involved 1254 consecutive patients with suspected or known CAD referred for coronary angiography. The blood samples including blood cell count, C-reactive protein, fibrinogen, uric acid, creatinine, and lipid spectrum were obtained after overnight fasting. One hundred and thirty-three patients were excluded due to incomplete records or inacceptable laboratory values. Differences among groups were tested with one-way ANOVA and Bonferroni post-hoc test for continuous variables and with chi-square test for categorical variables. Univariate and multivariate logistic regression was adopted for the analysis of risk factors and development of models for classification of patients into clinical categories.

**Results**. The linear logistic regression showed association of patient's biochemical markers with the presence of disease. Both acute and chronic CAD were associated with leukocyte count (Odds ratios 1.45 and 1.26), CRP (1.13; 1.05), fibrinogen (4.23; 1.95), uric acid (1.27; 1.38), creatinine (1.04; 1.04), HDL cholesterol (0.07; 0.12), triglycerides (1.4; 1.52) and glucose (1.56; 1.39). Presence of insignificant atherosclerosis was influenced only by fibrinogen (OR 1.73), creatinine (1.02), HDL cholesterol (0.5) and glucose level (1.23). There was no difference between one- and multivessel disease in laboratory values.

**Conclusion**. Leukocyte count, CRP level, triglycerides and uric acid are associated with the presence of both acute and chronic ischaemic heart disease, but not with number of stenosed vessels. In addition, glycemia, HDL cholesterol and namely fibrinogen and creatinine have relation to occurence of insignificant atherosclerosis.

## INTRODUCTION

The coronary artery disease (CAD) is one of the most frequent causes of mortality and morbidity in developed countries[1]. Coronary artery disease is caused by progress of atherosclerotic plagues in coronary arteries. The common risk factors of CAD are hypertension, hyperlipoproteinaemia, smoking and diabetes mellitus and also determined factors as age and male sex. Atherosclerosis is a complex process and it is considered to have an inflammatory background, so the association between levels of various inflammatory markers and occurence, severity, and clinical form CAD have been studied[2–6]. There are many evidences that inflammation plays a key role in the patogenesis of stable CAD[6–8] and acute coronary syndromes[9–12]. The most frequently studied parameters were leukocyte count[2,5,6,8,11,13–15], C-reactive protein (CRP) (ref.[3,4,7,10]), fibrinogen[16,17], and also uric acid[17–19]. There were found association of high hs-CRP levels and increased risk of further coronary events[7,10]. Danesh et al.[16] also found significant association of fibrinogen, CRP, albumin and leukocyte count with coronary artery disease by metaanalysis of prospective studies of CAD. Relation between increased level of uric acid and increased mortality in CAD patients was also described by Bickel et al.[19]. The aim of this study was to evaluate the association of leukocyte count, high sensitivity CRP (hsCRP), fibrinogen, and other laboratory parameters like creatinine and uric acid in patients with acute coronary syndromes and stable CAD and with multi – and singlevessel disease in stable CAD subgroups.

## METHODS

*Study population*

The study involved 1254 patients with suspected or known CAD referred for coronary angiography. The group of patients with CAD consisted of those with chronic stable CAD and acute coronary syndromes as well.

During the hospitalization the patients underwent full cardiologic investigation (history, physical examination, electrocardiography, laboratory examination, coronary angiography, echocardiography in patients with unclear diagnosis). All blood samples were taken after overnight fasting. The analysis of blood count was performed on analyzer SysMed XE 2100, Japan, fibrinogen level was determined according to Clause method on system BCS

XP, Siemens, Germany. The values of CRP, creatinine, lipid spectrum, uric acid were determined on analyzer Advia 1650, Siemens, Germany, by using kits BLW and BioVendor. Patients with severe renal (creatinine over 200 umol/l) or hepatic failure, anemia, endocrine or neurological diseases or malignancies were excluded. We also excluded patients with smooth coronary arteries having the evidence of myocardial infarction or spastic angina pectoris or patients with uncomplete laboratory and other examinations results. The history of myocardial infarcion or unstable angina within one month was classified as acute coronary syndrome. The hyperlipoproteinemia was defined as known diagnosis of hyperlipoproteinemia in patient's documentation and/or hypolipidemic treatment or total cholesterol level above 5 mmol/l in blood samples, diabetes mellitus as current treatment with hypoglycemic drugs or diet or repeat fasting glucose > 7.0 mmol/l during hospitalization, hypertension as current treatment with antihypertensive drugs or repeat resting blood pressure > 140/90 mmHg during hospitalization. All patients in-

**Table 1a.** Proportion of patients in groups according to CAD presence or absence and severity before and after data validation.

| Group | Sub-group | Before validation | | After validation | | No of excluded patients |
|---|---|---|---|---|---|---|
| | | N | % | N | % | |
| Acute CAD | | 270 | 21.5 | 249 | 22.2 | 21 |
| Chronic CAD | | 642 | 51.2 | 568 | 50.7 | 74 |
| | Singlevessel chronic CAD | 206 | 16.4 | 177 | 15.8 | 29 |
| | Multivessel chronic CAD | 436 | 34.8 | 391 | 34.9 | 45 |
| Insignificant atherosclerosis | | 126 | 10.0 | 109 | 9.7 | 17 |
| Control group | | 216 | 17.2 | 195 | 17.4 | 21 |
| Total | | 1254 | 100.0 | 1121 | 100.0 | 133 |

CAD – coronary artery disease, insignificant atherosclerosis – stenosis < 50%

**Table 1b.** Description of patients in study with comparison of acute and chronic CAD (basic characteristics and risk factors).

| | | All patients | Acute CAD | Chronic CAD | Insignificant atherosclerosis | Control group |
|---|---|---|---|---|---|---|
| | | (N = 1121) | (N = 249) | (N = 568) | (N = 109) | (N = 195) |
| Basic characteristics | Male sex†† | 70.0 | 70.7 | 77.5 | 64.2 | 50.8 |
| | Age (yrs)†† | 64.8 (64.2 ; 65.4) | 65.9 (64.6 ; 67.2)* | 65.7 (64.9 ; 66.5)* | 65.7 (64 ; 67.3) * | 60 (58.6 ; 61.4) |
| | Height (cm) | 171.3 (170.8;171.8) | 171.3 (170.2;172.4) | 171.9 (171.2;172.6) | 170.7 (168.9;172.5) | 170 (168.7;171.2) |
| | Weight (kg) | 84.2 (83.4 ; 85.1) | 84.2 (82.4 ; 86) | 84.7 (83.5 ; 85.9) | 83.7 (81 ; 86.3) | 83.2 (81.2 ; 85.3) |
| | EF (%) | 53.4 (52.6 ; 54.2) | 48.8 (47.3 ; 50.4)*§+ | 52.7 (51.6 ; 53.8)*+ | 58.9 (56.7 ; 61.1) | 58.2 (56.5 ; 59.9) |
| | BMI (kg/m$^2$) | 28.7 (28.4 ; 28.9) | 28.6 (28.1 ; 29.2) | 28.6 (28.3 ; 28.9) | 28.7 (27.9 ; 29.5) | 28.8 (28.1 ; 29.4) |
| Risk factors (%) | Hypertension† | 78.1 | 79.1 | 79.8 | 81.7 | 69.7 |
| | Diabetes mellitus†† | 28.4 | 34.5 | 31.5 | 22.9 | 14.4 |
| | Hyperlipoproteinemia†† | 78.5 | 79.9 | 84.3 | 67.0 | 66.2 |
| | Perifery artery disease†† | 8.1 | 15.3 | 8.6 | 0.9 | 1.5 |
| | History of stroke †† | 9.6 | 14.1 | 10.7 | 5.5 | 3.1 |
| | Smoking experience†† | 47.1 | 52.6 | 50.7 | 36.7 | 35.4 |

cathegorical variables are presented in %, continuous variables as mean (95% confidence interval)
† significant difference among groups – ANOV A / Chi-square test (p<0.05),
†† significant difference among groups – ANOVA / Chi-square test (p < 0.001),
* significant difference vs. control group – Bonferroni test (p<0.001)
§ significant difference vs. chronic CAD – Bonferroni test (p<0.001)
+ significant difference vs. insignificant atherosclerosis – Bonferroni test (p<0.001)
EF – left ventricular ejection fraction, BMI – body mass index

volved in this study gave informed consent and study was approved by institutional ethics comittee.

*Coronary angiography*

The coronary angiography was performed by femoral or radial artery approach using angiographic device Philips Allura Xper FD 10 (Philips, The Netherlands). The examinations were evaluated by two experienced cardiologists. Coronary artery disease was defined as more than 50% luminar diameter stenosis of at least one coronary artery. Patients with CAD were divided into groups of chronic stable CAD and acute coronary syndromes as described above, patients in stable CAD group were divided into subgroups with single- or multivessel disease.

Patients with insignificant atherosclerosis (luminal diameter narrowing below 50%) were given into separate group. Patients with smooth coronary arteries were taken as controls.

*Data validation and statistical analysis:*

One thousand two hundred and fifty-four patients were included into the study. After data evaluation 133 patients were excluded due to incomplete records or inacceptable laboratory values. In data evaluation crucial parameters were age, gender, body mass index (BMI), data from patient's history (history of hypertension, diabetes mellitus, stroke, known hyperlipoproteinemia, perifery artery disease, renal insufficiency and smoking) and biochemical parameters (hemoglobin, leucocytes, trombocytes, fibrinogen, prothrombin test, total cholesterol, low density lipoprotein (LDL) cholesterol, high density lipoproteid (HDL) cholesterol, triglycerides, uric acid, creatinine, glycemia, CRP). Finally, patients without performed examination from ventriculography were excluded due to not accessible value of left ventricular ejection fraction. Number of patients in the groups are presented in Table 1a.

**Table 2.** Laboratory markers in groups of acute and chronic CAD.

| | | All patients | Acute CAD | Chronic CAD | Insignificant atherosclerosis | Control group |
|---|---|---|---|---|---|---|
| | | (N = 1121) | (N = 249) | (N = 568) | (N = 109) | (N = 195) |
| Laboratory markers | **Leukocytes**[a††] **[x $10^9$/l]** | 7.5 (7.3 ; 7.6) | 8.2 (7.9 ; 8.5)§ ++** | 7.5 (7.3 ; 7.6)** | 7 (6.7 ; 7.3) | 6.7 (6.5 ; 7) |
| | **C-reactive protein**[a††] **[mg/l]** | 4.3 (4 ; 4.6) | 7.9 (6.8 ; 9.3)§ ++** | 3.8 (3.5 ; 4.1)* | 3.5 (2.9 ; 4.2) | 2.8 (2.5 ; 3.2) |
| | **Fibrinogen**[††] **[g/l]** | 4 (4 ; 4.1) | 4.4 (4.3 ; 4.5)§++** | 4 (3.9 ; 4)** | 3.9 (3.8 ; 4)* | 3.7 (3.6 ; 3.8) |
| | **Uric acid**[a†] **[umol/l]** | 355.2 (349.6 ; 361) | 356.2 (343.5;369.3) | 362.5 (354.7;370.6)* | 352.7 (336.7;369.4) | 335.1 (322.4;348.3) |
| | **Creatinine**[a††] **[umol/l]** | 100.3 (99.3 ;101.2) | 102.4 (100.3;104.5)** | 102.1 (100.7;103.5)** | 98.7 (95.9 ; 101.7)* | 93.3 (91.3 ; 95.3) |
| | **Cholesterol**[†] **[mmol/l]** | 4.5 (4.4 ; 4.6) | 4.4 (4.3 ; 4.6)* | 4.4 (4.4 ; 4.5)* | 4.6 (4.4 ; 4.8) | 4.7 (4.6 ; 4.8) |
| | **LDL**[a] **[mmol/l]** | 2.5 (2.4 ; 2.5) | 2.5 (2.4 ; 2.6) | 2.4 (2.4 ; 2.5)* | 2.5 (2.4 ; 2.7) | 2.6 (2.5 ; 2.7) |
| | **HDL**[a††] **[mmol/l]** | 1.1 (1.1 ; 1.2) | 1.1 (1 ; 1.1) ++** | 1.1 (1.1 ; 1.1) ++** | 1.2 (1.2 ; 1.3) | 1.3 (1.3 ; 1.4) |
| | **Triglycerides**[a†] **[mmol/l]** | 1.5 (1.5 ; 1.6) | 1.6 (1.5 ; 1.6)* | 1.6 (1.5 ; 1.7)* | 1.5 (1.3 ; 1.6) | 1.4 (1.3 ; 1.5) |
| | **Glucose**[a††] **[mmol/l]** | 5.7 (5.6 ; 5.8) | 6.1 (5.9 ; 6.4)§ + ** | 5.7 (5.6 ; 5.8)** | 5.5 (5.2 ; 5.7) | 5.2 (5 ; 5.3) |
| | **Trombocytes**[a††] **[x $10^9$/l]** | 202.1 (198.7;205.4) | 214.7 (206.6 ; 223)§ | 196.4 (191.9 ; 201) | 199.5 (189 ; 210.5) | 204.7 (197.7;211.9) |
| | **Hemoglobin**[†] **[g/l]** | 138.1 (137.2;138.9) | 135.1 (133.1 ; 137)§ | 139.5 (138.3;140.7) | 138.5 (136.3;140.7) | 137.5 (135.6;139.4) |

cathegorical variables are presented in %, continuous variables as mean (95% confidence interval)

[a] due to not normal distribution logaritmic transformation of the data was needed,

[†] significant difference among groups – ANOVA / Chi-square test ($p<0.050$),

[††] significant difference among groups – ANOVA / Chi-square test ($p<0.001$),

[§] significant difference between acute CAD and chronic CAD – Bonferroni test ($p<0.001$),

[+] significant difference vs. insignificant atherosclerosis – Bonferroni test ($p<0.05$),

[++] significant difference vs. insignificant atherosclerosis – Bonferroni test ($p<0.001$),

* significant difference vs. control group – Bonferroni test ($p<0.05$)

** significant difference vs. control group – Bonferroni test ($p<0.001$)

Basic statistical description of study population adopted percentage proportions for categorical parameters while the continuous variables were expressed as mean and 95% confidence interval or median and percentile range. Significant differences among groups were tested with one-way ANOVA and Bonferroni post-hoc test for continuous variables and with chi-square test for categorical variables.

Bonferonni post-hoc test was adopted as a solution for multiple testing problem; it is the correction for increased level of type I error during multiple testing with objective to reach=0.05 for all tests. Predictors in logistic regression were described by their odds ratio and confidence interval; their statistical significance was tested using Wald test which is a standard test for testing whether an independent variable has a statistically significant relationship with a dependent variable. Statistical significance of the whole logistic models was tested by means of Hosmer and Lemeshow test; the null hypothesis of the test is that there is no difference between the observed and predicted values of the dependent variable. If its p>0.05 we fail to reject the null hypothesis that there is no difference, implying that the model's estimates fit the data at an acceptable level. Analyses were performed using SPSS 12.0 and Statistica 8.0.

## RESULTS

Proportion of patients in groups according to CAD presence or absence and severity before and after data validation shows Table 1a. Patients with both acute and

**Table 3.** Laboratory markers in subgroups of multivessel and singlevessel CAD.

| | | All patients | Singlevessel chronic CAD | Multivessel chronic CAD | Control group |
|---|---|---|---|---|---|
| | | (N=763) | (N=177) | (N=391) | (N=195) |
| Laboratory markers | **Leukocytes**[a††] **[x $10^9$/l]** | 7.3 (7.2 ; 7.4) | 7.6 (7.3 ; 7.9)§§ | 7.4 (7.2 ; 7.6)§§ | 6.7 (6.5 ; 7) |
| | **C-reactive protein**[a†] **[mg/l]** | 3.5 (3.3 ; 3.8) | 3.8 (3.3 ; 4.5)§ | 3.8 (3.4 ; 4.2)§ | 2.8 (2.5 ; 3.2) |
| | **fibrinogen**[††] **[g/l]** | 3.9 (3.9 ; 3.9) | 3.9 (3.8 ; 4)§ | 4 (3.9 ; 4.1)§§ | 3.7 (3.6 ; 3.8) |
| | **uric acid**[a†] **[umol/l]** | 355.3 (348.5 ; 362.2) | 369 (353.9 ; 384.7)§ | 359.6 (350.5 ; 369)§ | 335.1 (322.4 ; 348.3) |
| | **Creatinine**[a††] **[umol/l]** | 99.8 (98.6 ; 101) | 100.9 (98.6 ; 103.2)§§ | 102.7 (101 ; 104.5)§§ | 93.3 (91.3 ; 95.3) |
| | **Total cholesterol**[†] **[mmol/l]** | 4.5 (4.4 ; 4.6) | 4.5 (4.3 ; 4.6) | 4.4 (4.3 ; 4.5)§ | 4.7 (4.6 ; 4.8) |
| | **LDL**[a] **[mmol/l]** | 2.5 (2.4 ; 2.5) | 2.5 (2.3 ; 2.6) | 2.4 (2.3 ; 2.5) | 2.6 (2.5 ; 2.7) |
| | **HDL**[a††] **[mmol/l]** | 1.2 (1.1 ; 1.2) | 1.2 (1.1 ; 1.2)§§ | 1.1 (1.1 ; 1.1)§§ | 1.3 (1.3 ; 1.4) |
| | **Triglycerides**[a††] **[mmol/l]** | 1.6 (1.5 ; 1.6) | 1.5 (1.5 ; 1.6) | 1.6 (1.6 ; 1.7)§§ | 1.4 (1.3 ; 1.5) |
| | **Glucose**[a††] **[mmol/l]** | 5.6 (5.5 ; 5.6) | 5.5 (5.4 ; 5.7)§ | 5.8 (5.6 ; 5.9)§§ | 5.2 (5 ; 5.3) |
| | **Trombocytes**[a†] **[x $10^9$/l]** | 198.5 (194.7 ; 202.4) | 203.8 (196.5 ; 211.4) | 193.1 (187.6 ; 198.8)§ | 204.7 (197.7 ; 211.9) |
| | **Hemoglobin**[†] **[g/l]** | 139 (138 ; 140) | 141.8 (140 ; 143.6)*§ | 138.5 (137 ; 139.9)* | 137.5 (135.6 ; 139.4) |

cathegorical variables are presented in %, continuous variables as mean (95% confidence interval)
[a] due to not normal distribution logaritmic transformation of the data was needed,
[†] significant difference among groups – ANOVA / Chi-square test (p<0.050),
[††] significant difference among groups – ANOVA / Chi-square test (p<0.001),
[*] significant difference between singlevessel and multivessel chronic CAD – Bonferroni test (p<0.05),
[§] significant difference vs. control group – Bonferroni test (p<0.05)
[§§] significant difference vs. control group – Bonferroni test (p<0.001)

chronic CAD had significantly higher occurency of hypertension, diabetes, hyperlipoproteinemia, perifery artery disease, stroke, smoking experience and were markedly older. The left ventricular ejection fraction was also significantly lower in CAD patients (Table 1b).

The basic differences in laboratory parameters are presented in Table 2. Patients with acute forms of CAD had significantly higher leukocyte count, C-reactive protein and fibrinogen and also glucose. It is not surprising because inflammatory reaction is physiological in case of myocardial necrosis or atherosclerotic plaque rupture. Otherwise, in this parameters are also significant differences between patients with chronic CAD and controls that demonstrates the inflammatory background of atherosclerosis progress and development. From other parameters, patients with chronic CAD had higher level of uric acid, creatinine and lower HDL cholesterol. Results of lipid spectrum may seem paradoxical, because patients with CAD had lower total and LDL cholesterol, but this is caused by present hypolipidemic medication that was significantly more frequent in this group. The prevalence of hypolipidemic therapy was as follows: in chronic CAD group had 548 (96.5%) patients hypolipidemic drugs (530 had statin, 1 fibrate, 17 combination statin+fibrate), in acute CAD group was on therapy 243 patients (97.6%, 239 statin, 1 fibrate, 3 combination), in insignificant atherosclerosis group 83 patients (76.1%, all 83 had statin) and in control group had hypolipidemic drugs 49 patients (25.2%, 47 statin, 1 fibrate, 1 combination). Significant differences were found between groups with insignificant atherosclerosis and controls in fibrinogen and creatinine level only.

Detail division in subgroups with single- and multivessel chronic CAD is presented in Table 3. Inflammatory markers, uric acid and glucose were again significantly elevated both in one- and multivessel disease group against controls and HDL cholesterol was lower in this groups too. There was no significant difference between single- and multi vessel group in neither inflammatory markers nor other biochemical parameters, except for hemoglobin. This difference was probably casual, because patients with singlevessel CAD had higher hemoglobin level than those with multi-vessel but control group had lower than both groups with CAD.

The linear logistic regression showed association of patient's biochemical markers on presence of CAD (Table 4). Both acute and chronic CAD were associated with leukocyte count, CRP, fibrinogen, uric acid, creatinine, HDL cholesterol, triglycerides and glucose. On the other

**Table 4.** Influence of patient's biochemical parameters on presence of disease based on linear logistic regression.

| | | Acute CAD | Chronic CAD | Insignificant atherosclerosis | Singlevessel chronic CAD | Multivessel chronic CAD |
|---|---|---|---|---|---|---|
| | | (N = 249) | (N = 568) | (N = 109) | (N = 177) | (N = 391) |
| Laboratory markers | **Leucocytes** | 1.45 (1.30; 1.61) †† | 1.26 (1.14; 1.39) †† | 1.08 (0.95; 1.24) | 1.29 (1.15; 1.45) †† | 1.24 (1.12; 1.38) †† |
| | **C-reactive protein** | 1.13 (1.08; 1.17) †† | 1.05 (1.01; 1.08) † | 1.03 (0.99; 1.07) | 1.04 (1.00; 1.07) † | 1.05 (1.01; 1.09) † |
| | **Fibrinogen** | 4.23 (3.06; 5.86) †† | 1.95 (1.50; 2.54) †† | 1.73 (1.2; 2.51) † | 1.65 (1.21; 2.26) † | 2.16 (1.62; 2.88) †† |
| | **Uric acid (100 units)** | 1.27 (1.05 ; 1.54) † | 1.38 (1.15 ; 1.65)† | 1.21 (0.94 ; 1.56) | 1.46 (1.18 ; 1.82)†† | 1.34 (1.1 ; 1.62)† |
| | **Creatinine** | 1.04 (1.02; 1.05) †† | 1.04 (1.03; 1.05) †† | 1.02 (1.01; 1.04) † | 1.03 (1.02; 1.05) †† | 1.04 (1.03; 1.05) †† |
| | **Total cholesterol** | 0.79 (0.66; 0.95) † | 0.78 (0.67; 0.91) † | 0.88 (0.69; 1.12) | 0.78 (0.64; 0.97) † | 0.77 (0.65; 0.91) † |
| | **LDL** | 0.89 (0.72; 1.09) | 0.79 (0.66; 0.96) † | 0.89 (0.66; 1.2) | 0.78 (0.60; 1.02) | 0.79 (0.65; 0.96) † |
| | **HDL** | 0.07 (0.04; 0.15) †† | 0.12 (0.07; 0.20) †† | 0.50 (0.26; 0.98) † | 0.23 (0.12; 0.43) †† | 0.08 (0.04; 0.15) †† |
| | **Triglycerides** | 1.4 (1.06; 1.84) † | 1.52 (1.19; 1.94) †† | 1.09 (0.78; 1.53) | 1.33 (0.99; 1.79) | 1.57 (1.22; 2.02) †† |
| | **Glucose** | 1.56 (1.33; 1.82) †† | 1.39 (1.20; 1.61) †† | 1.23 (1.02; 1.48) † | 1.30 (1.09; 1.55) † | 1.42 (1.22; 1.65) †† |
| | **Trombocytes (50 units)** | 1.12 (1.02 ; 1.38)† | 0.9 (0.79 ; 1.04) | 0.95 (0.77 ; 1.17) | 0.98 (0.81 ; 1.19) | 0.87 (0.76 ; 1.01) |
| | **Hemoglobin** | 0.99 (0.98; 1.00) | 1.01 (1.00; 1.02) | 1.01 (0.99; 1.02) | 1.03 (1.01; 1.04) † | 1.00 (0.99; 1.02) |

† Wald test, significance p<0.050

†† Wald test, significance p<0.001

Data are presented as odds ratios with 95% confidence interval

hand, presence of insignificant atherosclerosis was influenced only by fibrinogen, creatinine, HDL cholesterol and glucose level. From clinical factors, significant relationship was found between age, male sex, hypertension, diabetes, hyperlipidemia, history of stroke, perifery artery disease, smoking experience and CAD (acute and chronic, singlevessel and multivessel as well). Insignificant atherosclerosis was associated only with male sex, age and hypertension.

## DISCUSSION

In our study we tested several laboratory parameters and their association with the presence and severity of coronary atherosclerosis. We proved that elevated inflammatory markers as leukocyte count, C- reactive protein and fibrinogen are associated primarily with acute forms of coronary artery disease and presence of chronic CAD, but not with the number of affected vessels in chronic CAD. Patients with multivessel chronic CAD had rather lower mean leukocyte count that those with single vessel disease. Also other parameters (uric acid, creatinine, blood lipids and glucose) failed to distinguish the number of diseased coronary arteries. All mentioned parameters were significantly different between CAD and control group, only fibrinogen and creatinine also between insignificant atherosclerosis and control group. So we cannot confirm findings from previous studies, e.g. Cavusoglu et al.[2], Sabatine et al.[5], that described the association between leukocyte count and the number of significantly narrowed coronary arteries. The linkage between insignificant atherosclerosis and fibrinogen and creatinine level corresponded to previous findings. Levenson et al.[20,21] demonstrated that prevalece of atherosclerotic plaques was significantly more pronounced with increasing tertile of fibrinogen levels. The authors also found the synergic effect between fibrinogen and total/HDL cholesterol ratio in formation of subclinical coronary and extracoronary atherosclerosis. The role of renal function and creatinine was described by several authors. Bartnicky et al.[22] found out the increased odds ratio of coronary artery disease in patients with decreased glomerulal filtration. Cerne et al.[23] described the mildly elevated serum creatinine to be associated with the extent of coronary atherosclerosis independently of conventional risk factors. Mild renal insuficiency is also associated with reduced coronary flow in patients with non-obstructive coronary artery disease. That can be caused by synchronous changes in the renal and coronary microcirculation[24].

Our study has several limitations. The number of subjects was relatively large, but it was selected population referred for coronary angiography. Also influence of blood lipid spectrum could not be exactly examined due to the present hypolipidemic medication in CAD patients.

In conclusion, laboratory parameters as leukocyte count, CRP level, triglycerides and uric acid are associated with the presence of coronary artery disease (both acute and chronic) but not with the number of diseased vessels. In addition, glycemia, HDL cholesterol and namely fibrinogen and creatinine have relation to the occurence of insignificant atherosclerosis.

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