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# Risk Factor Analysis and Diagnoses of Coronary Heart Disease in Patients with Hypercholesterolemia from Croatian Zagorje County

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## ABSTRACT

*Our aim is to determine if there exists a difference in risk factors and diagnosis between patients being treated on internal medicine ward for coronary heart disease who have higher levels of cholesterol in their blood and other patients, without proved higher levels of cholesterol, hospitalized for coronary heart disease. We followed patients hospitalized in General Hospital Zabok for coronary heart disease for the period between 2004–2006y. On admission patients were diagnosed with coronary heart disease based on laboratory markers specific for the disease (CK, troponin, LDH, CRP), ECG and history taking. We analyzed two groups of patients for diagnosis and risk factors on discharge from the hospital: one group with proven hypercholesterolemia, the other with coronary heart disease without hypercholesterolemia. For the duration of the study there were no significant alternations concerning risk factors for coronary heart disease, and hypertension was the most prevalent of these factors in both groups. Values of HDL, as an indirect indicator of coronary heart disease, were lower in both groups for the duration of the study. In group of patients with hypercholesterolemia myocardial infarction with a ST segment elevation, as a discharge diagnosis, was a more prevalent complication of the disease, while for the group of patients without hypercholesterolemia stable angina pectoris was more prevalent and this is explained as atheroma plaque stabilization when there are normal values of blood cholesterol.*

**Key words:** hypercholesterolemia, prevalence of risk factors, cardiovascular disease, coronary heart disease

## Introduction

Our aim is to determine if there exists a difference in risk factors and diagnosis between patients being treated on internal medicine ward for coronary heart disease who have higher levels of cholesterol in their blood and other patients, without proved higher levels of cholesterol, hospitalized for coronary heart disease.

Hyperlipoproteinemia, either primary or secondary, is defined as increased values of lipoprotein in plasma. Main lipids in plasma are total cholesterol and triglycerides. Classes of lipoproteins are very low density lipoproteins (VLDL), low density lipoproteins (LDL) and high density lipoproteins (HDL)<sup>1-3</sup>.

Hypercholesterolemia is a result of either increased production or decreased elimination of very low density

lipoproteins (VLDL) which is followed by increased production of low density lipoproteins (LDL) from VLDL. Increased synthesis of VLDL in liver is related to obesity, diabetes, alcoholism, nephrotic syndrome, or genetic predisposition. Any of these conditions leads to an increased concentrations of total cholesterol (TC) and LDL and is frequently followed by increased concentrations of triglycerides in blood<sup>1,2,3</sup>. Optimal values for cholesterol in blood, for a middle age person without coronary heart disease, are defined as below 5.1 mmol/L, while hypercholesterolemia is defined as values above 5.1mmol/L. In clinical practice it is sufficient to determine values of total cholesterol, low density lipoproteins and triglycerides. Increased concentration of low density lipoproteins (LDL)

and decreased concentrations high density lipoproteins (HDL) predisposes patients to atherosclerotic disease.<sup>1–3</sup> Coronary atherosclerosis is characteristically insidious in onset, uneven in distribution and rupture of eccentric atheromatous plaque leads to a sudden occlusion of a vessel, due to formation of intramural thrombus, which stops blood flow to heart muscle. Leading complications of coronary heart disease are angina pectoris, unstable angina, and myocardial infarction and main risk factors are high concentrations of LDL and triglycerides, low concentrations HDL in blood, smoking, diet, lifestyle, and some systemic diseases such as arterial hypertension and diabetes<sup>1–4</sup>. Correlation between increased values of total cholesterol and LDL in serum and coronary heart disease is direct and permanent. Higher levels of HDL lower the risk. Lowering concentrations of LDL slows the progression of coronary heart disease and it is beneficiary to patients already suffering from the disease, even if their LDL concentrations aren't increased<sup>2,3,6,7</sup>.

Population of 90 000 gravitates towards General Hospital Zabok with 3600 patient being hospitalized on internal medicine ward yearly. Number of patients being treated for coronary heart disease is between 150 and 220. All of the hospitalized patients for this disease either had it already diagnosed previously or the diagnosis was established during the hospitalization through non-invasive diagnostic procedures (chest radiogram, ECG, 24-hour recording of ECG and blood pressure, heart echosonogram, endurance testing and lab works indicating coronary disease – troponin, c-reactive protein CRP, creatine kinase CK, lactate dehydrogenase LDH). On admission, all patient being suspected of having a coronary heart disease, or those who already have the disease proved, ECG and chest x-ray is performed, as well as lab markers specific for coronary heart disease. Within 24-hours on admission lipid profile (TC, triglycerides, LDL, HDL) is performed. Anamnesis is focused on risk factors for coronary heart disease, which is later confirmed with subsequent noninvasive clinical and laboratory testing. On discharge from the hospital patients, including those who were diagnosed for the first time, had laboratory and clinically proved coronary heart disease, with known risk factors obtained by history taking<sup>6–8</sup>.

One group of patients, those with known coronary heart disease and suffering from acute myocardial infarction with elevation of ST segment, being hospitalized within 6 hours from the onset of symptoms, had an invasive heart procedure – coronary angiography. These patients were taken to other hospitals or centers to have this procedure performed and were returned to our hospital within 48 hours. Risk factor analysis and patient profile were obtained on admission, prior to invasive heart procedure.

## Subjects and Methods

We followed patients hospitalized in General Hospital Zabok for coronary heart disease for the period between 2004–2006y. On admission patients were diagnosed with

coronary heart disease based on laboratory markers specific for the disease (CK, troponin, LDH,CRP), ECG and history taking. We analyzed two groups of patients for diagnosis and risk factors on discharge from the hospital: one group with proven hypercholesterolemia, the other with coronary heart disease without hypercholesterolemia. We compared risk factors within these two groups, as well as blood concentrations of HDL and LDL. Hypercholesterolemia was defined as a value of cholesterol in blood greater than 5.1 mmol/L; higher values of triglycerides were taken as those over 1.7 mmol/L; LDL lower than 3 mmol/L and HDL greater than 1 mmol/L.

High LDL level is defined by the value > 3,0 mmol/L

High HDL level is defined by the value < 1,0 mmol/L

## Results

We followed patients hospitalized in General Hospital Zabok for coronary heart disease for the period between 2004–2006y. On admission patients were diagnosed with coronary heart disease based on laboratory markers specific for the disease (CK, troponin, LDH,CRP), ECG and history taking. We analyzed two groups of patients for diagnosis and risk factors on discharge from the hospital: one group with proven hypercholesterolemia, the other with coronary heart disease without hypercholesterolemia. We compared risk factors within these two groups, as well as blood concentrations of HDL and LDL. Hypercholesterolemia was defined as a value of cholesterol in blood greater than 5.1 mmol/L; higher values of triglycerides were taken as those over 1.7 mmol/L; LDL lower than 3 mmol/L and HDL greater than 1 mmol/L.

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Data were presented in Figures.

Figure 1 presents profile of risk factor for patients with and without hypercholesterolemia on discharge from the hospital during 2004. Figure 2 presents blood concentration of LDL and HDL for patients with and without hypercholesterolemia on discharge from the hospital during 2004. Figure 3 presents diagnosis on discharge from the hospital for patients with and without hypercholesterolemia during 2004. Figure 4 presents profile of risk factor for patients with and without hypercholesterolemia on discharge from the hospital during 2005.

Figure 5 presents blood concentration of LDL and HDL for patients with and without hypercholesterolemia on discharge from the hospital during 2005. Figure 6 presents diagnosis on discharge from the hospital for patients with and without hypercholesterolemia during 2005. Figure 7 presents profile of risk factor for patients with and without hypercholesterolemia on discharge from the hospital during 2006. Figure 8 presents blood concentration of LDL and HDL for patients with and without hypercholesterolemia on discharge from the hospital during 2006. Figure 9 presents diagnosis on dis-

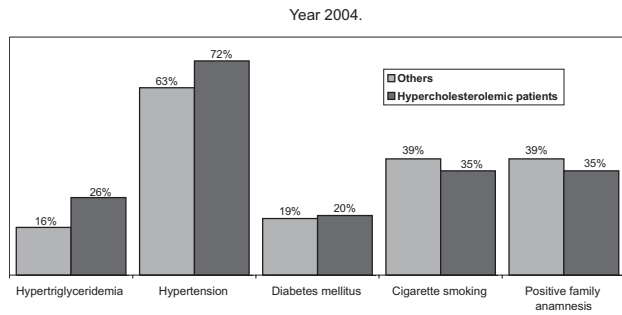


Fig. 1. presents profile of risk factor for patients with and without hypercholesterolemia on discharge from the hospital during 2004.

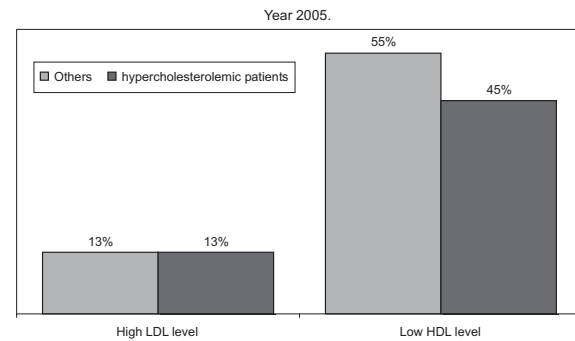


Fig. 5. presents blood concentration of LDL and HDL for patients with and without hypercholesterolemia on discharge from the hospital during 2005.

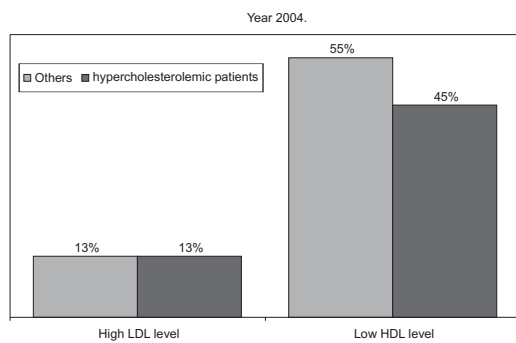


Fig. 2. presents blood concentration of LDL and HDL for patients with and without hypercholesterolemia on discharge from the hospital during 2004.

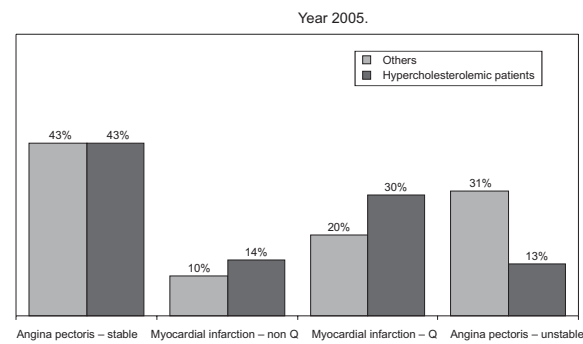


Fig. 6. presents diagnosis on discharge from the hospital for patients with and without hypercholesterolemia during 2005.

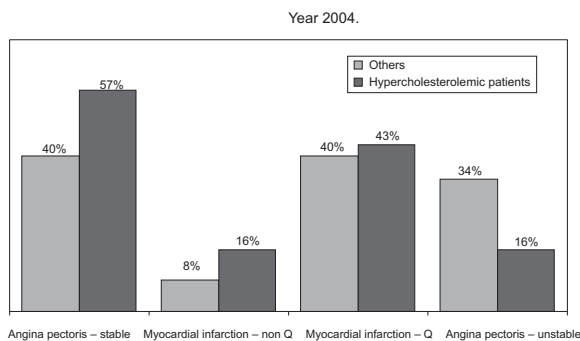


Fig. 3. presents diagnosis on discharge from the hospital for patients with and without hypercholesterolemia during 2004.

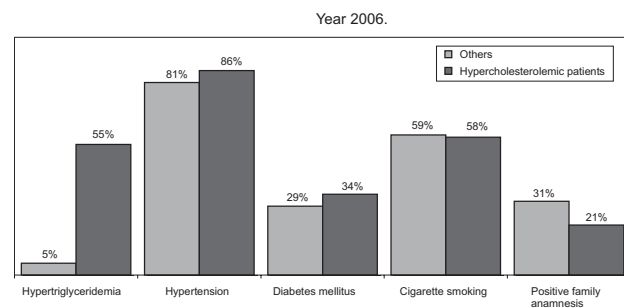


Fig. 7. presents profile of risk factor for patients with and without hypercholesterolemia on discharge from the hospital during 2006.

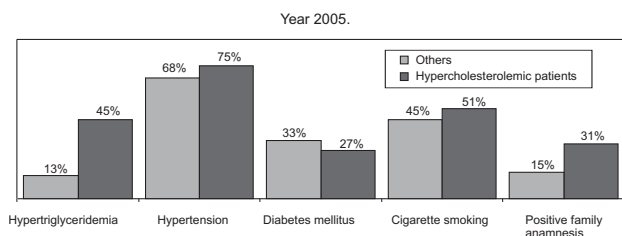


Fig. 4. presents profile of risk factor for patients with and without hypercholesterolemia on discharge from the hospital during 2005.

charge from the hospital for patients with and without hypercholesterolemia during 2006.

## Discussion

For the period between 1.1.2004. to 31.12.2004. a total of 183 patients were treated on internal medicine ward in General Hospital Zabok for coronary heart disease. Hypertension was prevalent in 72% of cases for patients with hypercholesterolemia, which was proved at

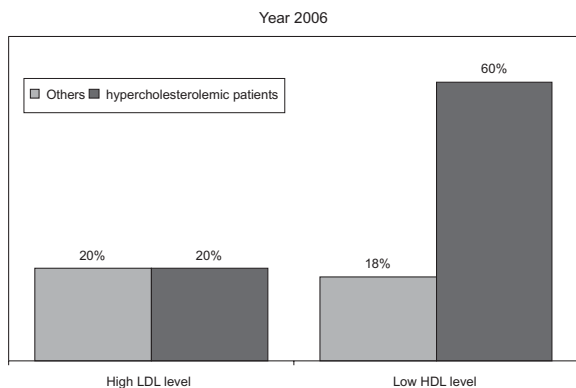


Fig. 8. presents blood concentration of LDL and HDL for patients with and without hypercholesterolemia on discharge from the hospital during 2006.

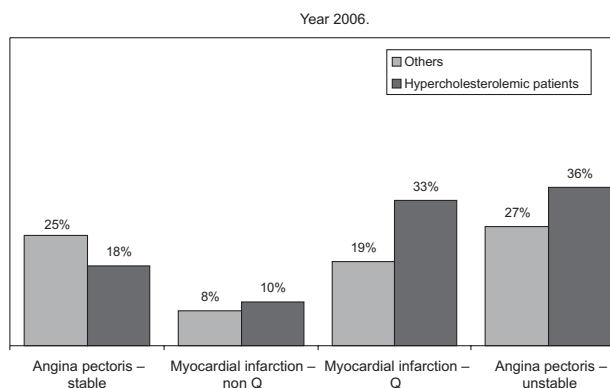


Fig. 9. presents diagnosis on discharge from the hospital for patients with and without hypercholesterolemia during 2006.

discharge, compared with 63% for patients without proved hypercholesterolemia. Increased values of triglycerides, as a risk factor, were prevalent in 26% of cases for patients with hypercholesterolemia and 16% for patients in the other group. Diabetes, as a risk factor for coronary heart disease, was evenly distributed – 20% in patients with hypercholesterolemia and 16% in patients without hypercholesterolemia. Family history for coronary heart disease and smoking were prevalent in lesser amount in patients with hypercholesterolemia (family history 35%, smoking 35%) when compared with the other group (family history 39%, smoking 39%). We found no significant differences when analyzing blood values of LDL and HDL between two groups. Both groups showed increased values of LDL (13%), while lower values of HDL were found in 55% of the cases for patients without hypercholesterolemia, compared to 45% of the cases for the patients with hypercholesterolemia. In this study, unstable angina pectoris and myocardial infarction with ST segment elevation were more prevalent amongst the patients with hypercholesterolemia, while unstable angina and myocardial infarction without ST segment elevation were more prevalent in patients without hypercholesterolemia. (Patients with hypercholesterolemia at discharge: stable angina pectoris 57%, acute myocardial infarction with ST segment elevation 43%, unstable angina pectoris 16%, and myocardial infarction without ST segment elevation 16%. Patients without hypercholesterolemia at discharge: stable angina pectoris 40%, myocardial infarction with ST segment elevation 40%, unstable angina 34%, and myocardial infarction without ST segment elevation 8%.)

In the year 2005, due to the coronary heart disease 220 patients were treated in General Hospital Zabok. When analyzing risk factors between the patients with and without hypercholesterolemia the greatest differences were noted regarding increased values of triglycerides. Increase values of triglycerides, as a risk factor, were significantly more prevalent amongst the patients with hypercholesterolemia (45%,  $p=0.000$ ) when compared with patients without hypercholesterolemia (13%).

Other differences between these two groups were not statistically significant. Analysis of values of LDL and HDL in two groups were not significant (LDL  $p=0.940$ ; HDL  $p=0.265$ ). For patient with hypercholesterolemia we found lower values of HDL in 45% of the cases and increased values of LDL in 13%. For patients without hypercholesterolemia we found lower values of HDL in 55% of the cases, while the increased values of LDL (13%) were the same as in the group of patients with hypercholesterolemia and the same as the year before. When comparing prevalence of complications of coronary heart disease we found no significant differences between the two groups. Myocardial infarction with ST segment elevation was found in 30% of the cases in patients with hypercholesterolemia; myocardial infarction without ST segment elevation in 14%; stable angina pectoris in 43%; unstable angina 13%. In patients without hypercholesterolemia, myocardial infarction with ST segment elevation was found in 20% of the cases; myocardial infarction without ST segment elevation 10%; stable angina pectoris 43%; unstable angina 31%.

In General Hospital Zabok, for the year 2006, we treated a total of 146 patients for coronary heart disease. When analyzing risk factors between the patients with and without hypercholesterolemia the greatest differences were noted regarding increased values of triglycerides. Increase values of triglycerides, as a risk factor for coronary heart disease, were significantly more prevalent amongst the patients with hypercholesterolemia. Amongst the patients with hypercholesterolemia increased values of triglycerides, as a risk factor, were noted in 55% of the cases, while only in 5% of the cases for patients without hypercholesterolemia ( $p=0.000$ ). We found no statistically significant differences between these two groups regarding other risk factors for coronary heart disease. For patient with hypercholesterolemia prevalence of other risk factors for coronary heart disease is as follows: diabetes in 34%, hypertension in 86%, smoking in 58%, and positive family history in 21% of the cases.

For patient without hypercholesterolemia prevalence of other risk factors for coronary heart disease is as follows: diabetes in 29%, hypertension in 81%, smoking in

59%, and positive family history in 31% of the cases. There is significantly higher percentage of patients with hypercholesterolemia who have lower values of HDL, comparing it with the other group, while there was no significant difference when evaluating increased values of LDL between the two groups. Evaluation of complications of coronary heart disease showed that myocardial infarction with a ST segment elevation is significantly more prevalent in patients with hypercholesterolemia, while stable angina pectoris was significantly less prevalent in patients without hypercholesterolemia. Differences regarding other complications of the coronary heart disease were not significant between the two groups at the time of discharge.

## Conclusion

For the duration of the study there were no significant alternations concerning risk factors for coronary heart disease, and hypertension was the most prevalent

of these factors in both groups. Values of HDL, as an indirect indicator of coronary heart disease, were lower in both groups for the duration of the study. In group of patients with hypercholesterolemia myocardial infarction with a ST segment elevation, as a discharge diagnosis, was a more prevalent complication of the disease, while for the group of patients without hypercholesterolemia stable angina pectoris was more prevalent and this is explained as atheroma plaque stabilization when there are normal values of blood cholesterol. More of a complex education of the whole population is needed to reduce the number and prevalence of risk factors for coronary heart disease, which is one of leading diseases causing mortality and morbidity in our county, as well as in developed countries in Europe. Younger population should be included in the education program as well. This would prevent the occurrence of risk factors, by changing diet and lifestyle, more so in groups with increased values of blood cholesterol, a population in risk. Such a program should be the only correct path for prevention of coronary heart disease<sup>2,5,6,10</sup>.

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## ANALIZA RIZIČNIH ČIMBENIKA I DIJAGNOZE KORONARNE BOLESTI SRCA KOD PACIJENTA SA HIPERHOLESTEROLEMIJOM U BOLESNIKA IZ HRVATSKOG ZAGORJA LIJEČENIH NA ODJELU INTERNE MEDICINE OPĆE BOLNICE ZABOK

### S A Ž E T A K

Utvrđiti da li postoje razlike rizičnih čimbenika i dijagnoze koronarne bolesti srca kod pacijenata sa hiperholesterolemijom prema ostalima, koji su zbog dijagnoze koronarne bolesti srca hospitalizirani na internom odjelu. U periodu od 2004. godine do 2006. godine praćeni su pacijenti hospitalizirani u Općoj bolnici Zabok zbog koronarne bolesti srca. Kod pacijenata se kod prijema profilom markera za koronarnu bolest/CK, troponin, LDH, CRP/, elektrogardiogramom, anamnestičkim podacima utvrđivala dijagnoza koronarne bolesti srca. Po otpustu analizirane su dvije grupe pacijenata po dijagnozama i rizičnim faktorima i to grupa pacijenata koja je imala dokazanu hiperholesterolemiju prema grupi koja nije imala dokazanu hiperholesterolemiju. Tijekom cijelog perioda praćenja nije bilo značajne promjene u profilu rizičnih čimbenika, hipertenzija je tijekom cijelog perioda bila najčešće utvrđeni rizični čimbenik u obje grupe. HDL kolesterol kao indirektni pokazatelj rizika koronarne bolesti bio snižen podjednako u obje grupe tijekom cijelog perioda

praćenja. U grupi pacijenata sa hiperholesterolemijom češće je kao otpusna dijagnoza utvrđen akutni infarkt miokarda sa elevacijom spojnice dok je kod ostalih stabilna angina pectoris što govori u prilog stabilizacije plaka kod normalnih vrijednosti holesterola prema nestabilnom plaku kod povišenih vrijednosti holesterola.