Acute myocardial infarction risk factors among population with premature cardiovascular disease

Czynniki ryzyka ostrego zespołu wieńcowego u osób z przedwczesną chorobą sercowo-naczyniową

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Abstract

Introduction. Cardiovascular diseases are the main cause of death worldwide. In the last 40 years we can observe an increase in prevalence of CVDs among young population [1]. Control of risk factors is especially important in young group of patients because the long-term prognosis for this group is particularly unfavorable [2].
Materials and methods. Medical records of the one hundred consecutive patients hospitalized between 2014–2017 in the Department of Cardiac and Vascular Diseases in Cracow Specialist Hospital were analyzed, with special emphasis put on the presence of the myocardial infarction risk factors. The study included 58 women under the age of 55 and 42 men younger than 45 years old, who were divided into two groups: with or without history of acute coronary syndrome.
Results. The studied population consisted of 58% of females, median age of all subjects was 45.5 years (42.75; 53; Q1; Q3 respectively). 86% were characterized by the increased LDL concentrations higher than 1.8 mmol/l, 65% have smoked cigarettes and 86.4% had thickened intima-media complex. HDL level was below the norm in 47.4% of the group with ACS and only in 20.9% of the group without ACS (P = 0.006). Additionally, significant differences between the groups in combined risk factors were observed, i.e.: decreased HDL level accompanied by increased LDL (40.4% with ACS, 20.9% without ACS; P = 0.04), past and current cigarettes smoking (38.6% with ACS, 18.6% without ACS; P = 0.03) or arterial hypertension (40.4% with ACS, 18.6% without ACS; P = 0.02).
Conclusion. The most important risk factor of acute myocardial infarction in the studied group with early onset of CVD was reduced HDL level.
Key words: risk factors, premature cardiovascular disease, acute myocardial infarction

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Streszczenie

Wstęp. Choroby sercowo-naczyniowe są główną przyczyną zgonów na świecie. W ostatnich 40 latach obserwuje się wzrost występowania ChSN w młodej populacji [1]. Kontrola czynników ryzyka jest szczególnie istotna u młodszych pacjentów, ponieważ długoterminowe prognozy dla tej grupy są szczególnie niekorzystne [2].
Materiały i metody. Przeanalizowano historie chorób 100 kolejnych pacjentów hospitalizowanych w Klinice Chorób Serca i Naczyń w Szpitalu im. Jana Pawła II w Krakowie (2014–2017), ze szczególnym uwzględnieniem czynników ryzyka chorób sercowo-naczyniowych. Do badania włączono 58 kobiet poniżej 45. roku życia oraz

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42 mężczyzn poniżej 55. roku życia. Pacjentów podzielono na dwie grupy według kryterium przebytego ostrego zespołu wieńcowego (OZW) w przeszłości.

Wyniki. Kobiety stanowiły 58% badanej populacji, mediana wieku wszystkich badanych wynosiła 45,5 roku (42,75; 53; odpowiednio Q1; Q3). U 86% pacjentów z badanej populacji stwierdzono stężenie cholesterolu frakcji LDL powyżej 1,8 mmol/l, 65% paliło papierosy, a u 86,4% stwierdzono pogrubiony kompleks *intima–media*. Stężenia cholesterolu frakcji HDL poniżej normy odnotowano u 47,4% osób w grupie z historią OZW i tylko u 20,9% w grupie bez OZW (p = 0,006). W występowaniu kombinacji czynników ryzyka istotne różnice między grupami zaobserwowano przy obniżonym stężeniu cholesterolu frakcji HDL, któremu towarzyszyło podniesione stężenie LDL (40,4% z OZW, 20,9% bez OZW; p = 0,04), palenie papierosów (38,6% z OZW, 18,6% bez OZW; p = 0,03) lub nadciśnienie tętnicze (40,4% z OZW, 18,6% bez OZW; p = 0,02).

Wnioski. Najważniejszym czynnikiem ryzyka ostrego zespołu wieńcowego w badanej populacji było obniżone stężenie cholesterolu HDL.

Słowa kluczowe: czynniki ryzyka, przedwczesna choroba wieńcowa, ostry zespół wieńcowy

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Introduction

Cardiovascular diseases (CVDs) are disorders of the heart and blood vessels that include coronary heart disease, cerebrovascular disease, rheumatic heart disease and other conditions. Four out of five CVD deaths are due to heart attacks and strokes [3]. CVDs are the most common causes of death among European population, despite available novel diagnostic tools and treatment modalities. In 2015 approximately 17.7 million people died of CVDs, in comparison to 8.9 million deaths caused by cancer, worldwide [4]. Although the deaths related to CVDs occur the most frequently in older patients (61% in the 70+ age group [5]), the ischaemic heart disease is also a leading cause of death in Europe in younger populations (above 30 years old) [4].

In Poland in the years between 1960 and 1991 there was a notable increase in deaths caused by CVDs — from 23.4% to 52.7% of all deaths. This is evident even despite recent decrease in CVD-related mortality to 45.1% (in 2014) and it is still much higher than an average for the EU (38.1%). These numbers may be caused by poor control of the cardiovascular risk factors in Polish society: more than half of population has excess weight and lacks physical activity, 77% of adults are diagnosed with dyslipidemia, out of which only 6% is treated, and 30% of men and 20% of woman smoke. All in all, more than 90% of men and 89% of women have at least one CVD risk factor [6]. This may partially be a consequence of an inadequate awareness of the cardiovascular risk factors during early life, as shown among high-school adolescents [7].

In effort to reduce the impact of CVD on our societies, more effective preventive measures need to be implemented, as the vast majority of the CVDs may be avoided by modifiable risk factors control [8], such as obesity, smoking, excessive alcohol use and efficient treatment of the comorbidities such as arterial hypertension or diabetes mellitus [9].

The management of the modifiable CVD-risk factors constitutes routine clinical practice in middle-aged and elder patients, but they are also important in young adults. Even though less than 10% of all patients with MI are below the age of 45, autopsies show that approximately 50% of young individuals have evidently obliterated coronary arteries [10]. In this study we aimed to examine prevalence of CVD risk factors in population of patients with diagnosis of premature cardiovascular disease, with and without history of ACS, as the long-term prognosis for these patients is not favourable [2]. We also sought to investigate the differences in prevalent CVD-risk factors between the defined groups.

Material and methods

One hundred consecutive medical records of patients hospitalized between 2014 and 2017 in the Department of Cardiac and Vascular Diseases in John Paul II Clinical Hospital in Cracow were analyzed. We specifically focused on the myocardial infarction risk factors. The inclusion criteria were: 1. cardiovascular disease confirmed by angiography and 2. the age limit at 55 of years for women and 45 years for men. All patients were characterized by very high 10-years risk of fatal myocardial infarction assessed with the ESC 2016 guidelines [7].

Twelve risk factors were analyzed: increased low-density lipoprotein (LDL) serum concentrations, decreased high-density lipoprotein (HDL)

serum concentration, triglycerides (TG) level over the norm, total cholesterol ratio over the norm, high-sensitivity CRP (hsCRP) over the norm, arterial hypertension (AH), diabetes mellitus (DM), intima-media thickness (IMT), body mass index (BMI), myocardial infarction (MI) history, smoking history, family history.

While examining the aforementioned factors following cut-off values for patients with very high risk of fatal myocardial infarction in next ten years were assumed: 4.9 mmol/L for total cholesterol ratio, 1.8 mmol/L for LDL, 1.7 mmol/L for TG, for HDL: 1 mmol/L for men and 1.3 mmol/L for women, 3.1 mg/L for CRP, 60 ml/min/1.73 m^2 for eGFR.

Means and standard deviations were calculated for the following risk factors in studied population: LDL level, total cholesterol, BMI. Median and quartiles were calculated for: HDL, TG and hsCRP concentrations.

The comparative analysis was performed between the two subgroups of patients i.e.: with, and without the history of the acute coronary syndrome (ACS). The group with the history of ACS consisted of 30 women with median of age 51.5 (49; 53.75; Q1; Q3 respectively), and 27 men with median of age 42 (40.5; 43). The subgroup without the history of ACS consisted of 28 women with median of age 53 (52; 54) and 15 men aged 42 (40; 44) years old.

Statistical analysis

All statistical analyses were performed with Statistica v.13, StatSoft, PL. Data are presented as means ± SD, medians (Q1; Q3) or number and percentage (n, [%]). Differences in the occurrence of the risk factors, and prevalent comorbidities in both groups were calculated using chi-square test. t-Student test, and Mann-Withney test were used for quantitative variables, where appropriate.

Missing data were substituted with the population means (three patients with no lipid profile). Seven of the patients missed data for hsCRP, eight for BMI, nineteen for IMC and thirty for family history, so data concerning these variables were analyzed accordingly for total patients of 93, 92, 81 and 70. To avoid major bias we decided not to include these variables in analysis of combined risk factors. P-value of less than 0.05 was considered valid for all calculations.

Results

Basic demographic and clinical data of patients are summarized in Table IA and IB. All of examined patients had two or more of examined risk factors/ /subclinical damage, with the median of six (Table IA). The most common ones in all studied population were LDL level above the norm (86%), and thickened intima-media complex (86.2%). 71% had established AH, 57% with history of smoking and 76.1% had BMI over 25 kg/m^2. Less common risk factors were: an increased CRP levels, low HDL, increased total cholesterol, TGs over the norm,

Table IA. Clinical characteristic of analyzed patients

Factors	All patients		With MI		Without MI		P-value
	Number	Percent	Number	Percent	Number	Percent	
Males	42	42%	27	47.37%	25	34.88%	0.21
Females	58	58%	30	52.63%	28	65.12%	0.21
LDL > N	86	86%	49	85.96%	37	86.05%	0.99
HDL < N	36	36%	27	47.37%	9	20.93%	0.006
TG > N	25	25%	16	28.07%	9	20.93%	0.41
TC > N	33	33%	18	31.58%	15	34.88%	0.73
hsCRP > N *	43	46.24%	28	53.85%	15	36.59%	0.10
AH	71	71%	42	73.68%	29	67.44%	0.50
DM	24	24%	14	24.56%	12	27.91%	0.71
IMC > N **	70	86.42%	40	85.11%	30	88.24%	0.68
BMI ≥ 25 ***	70	76.09%	39	78%	31	72.09%	0.64
Positive FH of MI****	34	48.57%	12	35.29%	22	61.11%	0.03
Smoking	65	67.71%	41	71.93%	24	55.81%	0.28

N — norm; MI — myocardial infarction; AH — arterial hypertention; DM — diabetes mellitus; HDL — high-density lipoprotein; LDL — low-density lipoprotein; IMC — intima media complex; hsCRP — high sensitivity C-reactive protein; FH — family history; BMI — body mass index; TG — triglicerydes, TC — total cholesterol

*percentages counted for patients with complete data (total: 93, with MI: 52, without MI: 41); **percentages counted for patients with complete data (total: 81, with MI: 47, without MI: 34); ***percentages counted for patients with complete data (total: 92, with MI: 50, without MI: 42); ****percentages counted for patients with complete data (total: 70, with MI: 34, without MI: 36)

Table IB. Clinical characteristics of patients with and without MI

Factors	All patients	With MI	Without MI	P-value
	Mean ± SD *median (q1;q3)	Mean ± SD *median (q1;q3)	Mean ± SD *median (q1;q3)	
Age (years)	45.5 (42.75; 53)*	44 (42; 52)*	51 (43; 53)*	0.08
BMI [kg/m^2]	28.5 ± 5.1	29.1 ± 5.0	27.8 ± 5.0	0.23
LDL [mmol/L]	2.9 ± 1.0	2.9 ± 1.1	2.9 ± 1.0	0.99
HDL [mmol/L]	1.6 (1.01; 1.24)*	1.14 (0.88; 1.37)*	1.45 (1.19; 1.72)*	0.0003
TG [mmol/L]	1.28 (0.96; 3.52)*	1.28 (0.99; 1.78)*	1.28 (0.90; 1.61)*	0.32
TC [mmol/L]	4.6 ± 1.1	4.5 ± 1.1	4.7 ± 1.0	0.31
hsCRP [mg/L]	2.16 (1; 6.62)*	4 (1.18; 6.94)*	1.73 (0.89; 5.32)*	0.08

Table II. Risk factors in patients with MI and without MI

Risk factors	All patients		With MI		Without MI		P-value
	Number	Percent	Number	Percent	Number	Percent	
HDL < N + LDL > N	32	32%	23	40.35%	9	20.93%	0.04
HDL < N + smoking	30	30%	22	38.60%	8	18.60%	0.03
HDL < N + AH	31	31%	23	40.35%	8	18.60%	0.02
HDL < N + DM	9	9%	7	12.28%	2	4.65%	0.19
LDL > N + smoking	57	57%	35	61.40%	22	51.16%	0.31
LDL > N + AH	58	58%	34	59.65%	24	55.81%	0.70
LDL > N + DM	20	20%	11	19.30%	9	20.93%	0.84
AH + smoking	47	47%	31	54.39%	16	37.21%	0.09
AH + DM	22	22%	12	21.05%	10	23.26%	0.79
DM + smoking	17	17%	12	21.05%	5	11.63%	0.21

decreased eGFR, presence of diabetes mellitus and positive family history of CVDs.

Differences between groups were observed in the decreased HDL level, as it was below the norm in 47.4% of population with ACS in history and only in 20.9% of patients without ACS. Positive family history concerning CVDs was noted in the records of 35.3% of patients with ACS in history and 61.1% of individuals without cardiac incident in the past (Table IA).

In the analysis of the combined risk factors the significant differences were seen in three instances: the coexistence of low HDL blood levels and an increased LDL levels, tobacco use or arterial hypertension. Prevalence of all three of them was similar and hovered around 40% of patients with ACS and 17% of patients without it, as seen in Table II.

Other than CV (cardiovascular), comorbidities were comparable between the groups. In the ACS-group eight patients had a neoplasm in their medical history, three of them being mammary cancer, in comparison to two cases of cancer in group without ACS. This data did not show significant difference between groups, much like other analyzed conditions (Table III).

Discussion

This study was focused on the analysis of CV risk factors among relatively young middle-aged patients with diagnosed coronary artery disease. In most cases, the prevalence of observed risk factors in groups was comparable to the distribution in general population [11]. However, the findings underscore the importance of HDL as a protective factor against ACS, as its low blood-level was observed more frequently in population with myocardial infarction in history. This trend repeats in the analysis of combined risk factors, as the only ones differentiating both groups included HDL blood levels. These results align with few previous observational studies,

Table III. Comorbidities occurence in studied patients

Comorbidity	All patients		With MI		Without MI		P value
	Number	Percent	Number	Percent	Number	Percent	
Arrhythmia	12	12%	5	8.8%	7	16.3%	0.25
Heart valve disease	17	17%	8	14.0%	9	20.9%	0.36
Arterial hypertension	71	71%	42	73.7%	29	67.4%	0.50
Diabetes mellitus	24	24%	14	24.6%	12	21.1%	0.71
Endocrine disorders other than DM	15	15%	8	14.0%	7	16.3%	0.76
Tumor	10	10%	8	14.0%	2	4.7%	0.12
Mental disorders	6	6%	3	5.3%	3	7.0%	0.72

like Framingham Study [12], where the major potential lipid risk factor of coronary heart disease was low HDL cholesterol.

Surprisingly, we observed that patients who never experienced ACS had more commonly positive family histories as compared to patients after ACS. One of the possibilities which could help to explain this difference is patients broader knowledge concerning such incidents and the awareness of the fact that they were at increased CVD risk. The other reason may be poorly taken history from patients with ACS, as enquiring about family history loses its importance in the light of underwent ACS or while managing fresh MI. Also the small number of patients (underpowered study) may limit this finding.

Another factor we noticed was the incidence of cancer in patients' history. While the numbers in both groups did not show statistical significance, we found it interesting that cancer morbidity was much higher, especially in group with ACS, than in general population of Poland [13]. This may be due to the usage of radiotherapy in the thoracic area to treat these conditions, which may increase the risk of CVD.

Due to the nature of analyzed material (medical records), incomplete data proved to be an obstacle in our work. Because of the lack of sufficient number of data concerning waist circumference (48 out of 100 patients), we could not include this factor in analysis. Information about behavioral risk factors, such as physical activity, diet or stress levels was rarely included in medical records. Patients' history of substance abuse was often incomplete, for example in specifying number of cigarettes smoked a day. It may be a necessary to carry out further studies concerning aforementioned risk factors or consider employing specified questionnaires in assessing them, as they are easily modifiable and can be a crucial part of MI prevention. As some measurements and tests were not conducted in all cases, probably due to the lack of indications (IMT measurements) or conditions (BMI in immobilised patients) it should be taken under consideration while analyzing the results.

We found that many of existing studies concern CVD risk factors in elder population, less attention is paid to younger patients. We think it is important to determine main problems of this group, so that assessing and managing their condition becomes easier. It may be worth to consider whether the tools commonly used to calculate the cardiac risk are appropriate for younger population.

Conclusion

All of the patients in the study had very high risk of MI in next ten years and in addition to treatment of their existing morbidities special attention should be paid to managing their risk factors of cardiac incidents. It should be achieved not only pharmacologically, but also by advocating for a change in a lifestyle, for example increasing physical activity or quitting smoking. These changes may help to reduce chance of MI in the future for example by increasing HDL-cholesterol level [14–16], as we found that although the most common CVD risk factor among studied population was elevated LDL-cholesterol level, it is HDL-cholesterol that may play crucial role in assessing the risk of ACS.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

As the study design was retrospective no Ethical Committee Board approval was mandatory, as regulated by the rules and regulations of our University.

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