

Knowledge and prevalence of risk factors for coronary artery disease in patients after the first and repeated percutaneous coronary intervention

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KEY WORDS

coronary artery disease, patient knowledge, secondary prevention

ABSTRACT

BACKGROUND Percutaneous coronary intervention (PCI) is an effective method for the treatment of coronary artery disease (CAD) that allows for a short hospital stay and fast recovery. It has been shown that PCI is a predictor of nonattendance at cardiac rehabilitation and correlates with poor adherence to lifestyle changes.

AIMS The study was conducted to evaluate the influence of education offered during PCI-related hospitalization on knowledge, awareness, and prevalence of self-reported risk factors for CAD.

METHODS We collected data using a self-designed 56-item questionnaire. Questions assessed the knowledge of CAD risk factors and the level of their control. The maximal knowledge score was 31 points and the maximal control score, 15 points.

RESULTS The study group consisted of 200 consecutive patients undergoing PCI. Patients with a history of PCI performed at least 8 weeks prior to their current hospitalization were included in the prior-PCI group (64%), whereas the pre-PCI group comprised patients with no history of revascularization (36%). The median (interquartile range [IQR]) knowledge score was 19 (12.5–23) points in the pre-PCI and 21 (12.5–24) points in the prior-PCI group ($P = 0.35$). The median (IQR) risk control score was 5 (4.5–7) points in the pre-PCI and 6 (4–8) points in the prior-PCI group ($P = 0.4$). There was no correlation between the level of knowledge and the actual prevalence of CAD risk factors. We found that 50% of the prior-PCI patients did not attend any rehabilitation, which correlated with poor control of CAD risk factors ($P = 0.001$).

CONCLUSIONS Currently used models of postprocedural education do not have an adequate effect on patient knowledge and do not bring recommended lifestyle changes.

INTRODUCTION Cardiovascular disease is the main cause of death in most European countries, responsible for 45% of all deaths.¹ Most of its risk factors can be modified and controlled. It has been recently reported that the control of cardiovascular risk factors in Europe is generally poor.² Percutaneous coronary intervention (PCI) is a minimally invasive procedure associated with a short hospital stay

lasting even less than 24 hours.³ Furthermore, PCI immediately relieves symptoms and causes less discomfort after the procedure compared with coronary artery bypass grafting. However, shorter hospitalization reduces the time for in-hospital education as well as the chance to review risk factors for coronary artery disease (CAD) and to initiate treatment of important yet often underappreciated factors

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WHAT'S NEW?

Although the European guidelines on cardiovascular disease prevention are well established, our study demonstrated that patients after percutaneous coronary intervention (PCI) (both first and repeated) are still poorly educated about the role of modifiable risk factors for coronary artery disease and its secondary prevention. It suggests that medical education in hospitals and outpatient departments is insufficient and ineffective. Current models of education implemented immediately after PCI and the timing of the procedure may be inadequate to induce recommended lifestyle changes. Every effort must be made to improve preventive practice so that it can meet the challenge posed by the progress in modern interventional cardiology.

such as obesity.⁴ The convenient procedure can make patients unaware of the severity of their disease and the impact of the intervention on the function of body systems.⁵ PCI was demonstrated as an independent predictor of nonattendance at cardiac rehabilitation and a predictor of poor adherence to lifestyle changes after the procedure.⁶ Despite the rapid development of PCI techniques, patients still lack knowledge and awareness of the necessity to prevent CAD. In recent years, only a slight improvement was observed in the control of risk factors for CAD in Poland.⁷ Thus, we sought to evaluate the influence of education offered during PCI-related hospitalization on knowledge, awareness, and prevalence of self-reported risk factors for CAD.

METHODS The study group included 200 consecutive patients admitted for elective PCI to the 2nd Department of Cardiology and Cardiovascular Interventions at the University Hospital in Kraków (Poland) from July 2016 to October 2018. We recruited patients with no history of revascularization (the pre-PCI group) and with a history of PCI defined as undergoing revascularization at least 8 weeks prior to the current hospitalization (the prior-PCI group). The data was collected using a self-designed 56-item questionnaire created on the basis of the 2016 European Society of Cardiology guidelines.⁸ The survey comprised questions about patients' sociodemographic and clinical profile, knowledge of CAD, and control of cardiovascular risk factors. Ten questions—some with subsections—concerned the level of knowledge and 1 point was given for each correct answer; the maximal score in this part was 31 points (Supplementary material, *Figure S1*). Risk control was assessed based on data from the survey (Supplementary material, *Figure S2*) and information obtained from patients' medical history, including blood pressure, fasting glucose, glycosylated hemoglobin, low-density lipoprotein, and total cholesterol levels (measurements taken during patients' current hospitalization). The maximal possible score for risk control was 15 points.

All patients were recruited by a trained medical researcher. Signed informed consent and consent to the processing of personal data were obtained. The study protocol was approved by the local ethics committee. The study was conducted in accordance with the ethical principles of clinical research based on the Declaration of Helsinki with its later amendments.

Statistical analysis Standard descriptive statistical methods were used to analyze the study data. The normality of the data was assessed with the Shapiro–Wilk test. Quantitative variables were described with mean (SD) or median (interquartile range [IQR]). Categorical variables were presented as numbers and percentages. The groups were directly compared using the χ^2 test for categorical variables. One-way analysis with the unpaired 2-sample *t* test (for normally distributed data) or the Mann–Whitney test (for data that do not have a normal distribution) was applied for quantitative variables. The independent correlations between quantitative variables were assessed with the Spearman rank correlation coefficient, whereas multiple regression analysis was applied to assess the possible impact of sociodemographic and clinical factors on the level of knowledge and the level of risk control. *P* values less than 0.05 were considered significant. All analyses were conducted with the Statistica software, version 13 (StatSoft, Inc., Kraków, Poland).

RESULTS All patients (*n* = 200) enrolled in the study were divided into 2 groups according to the history of PCI. The pre-PCI group included 72 patients (36%) and the prior-PCI group, 128 (64%). The sociodemographic and clinical profiles of the study groups are presented in [TABLES 1 and 2](#).

The median (IQR) level of knowledge was similar between the pre-PCI and prior-PCI groups (19 [12.5–23] points and 21 [12.5–24] points, respectively; *P* = 0.35). Also, no difference was observed in the median (IQR) level of risk control between both groups (5 [4.5–7] points and 6 [4–8] points, respectively; *P* = 0.4). The prevalence of particular risk factors for CAD in both groups is presented in [TABLE 3](#). Of all patients, 41% attended cardiac rehabilitation, 28% chose stationary rehabilitation in an inpatient unit, 12% ambulatory rehabilitation in an outpatient unit, and 11% rehabilitation at home. Stationary rehabilitation and home rehabilitation were attended more often by the prior-PCI patients and no difference in attendance was observed between the study groups with regard to ambulatory rehabilitation. Two percent of the pre-PCI patients and 13% of the prior-PCI patients attended more than 1 type of rehabilitation (*P* = 0.01).

In a multiple regression analysis, not attending any rehabilitation had an influence on

TABLE 1 Sociodemographic profile of the study patients

Variable		All patients (n = 200)	Pre-PCI (n = 72)	Prior-PCI (n = 128)	P value
Male sex		146 (73)	53 (73)	92 (72)	0.91
Age, y, mean (SD)		67.3 (11.5)	67 (11.6)	67.5 (9.6)	0.8
Education	Primary, secondary, or vocational	152 (76)	49 (68)	103 (81)	0.04
	Higher	48 (24)	23 (32)	25 (19)	
Current marital status	Married	146 (73)	50 (70)	96 (75)	0.52
	Not married	54 (27)	22 (30)	32 (25)	
Place of residence	Rural area	48 (24)	17 (24)	31 (24)	0.98
	City	152 (76)	55 (76)	97 (76)	
Net monthly household income	<4000 PLN ^a	156 (78)	52 (72)	104 (81)	0.22
	>4000 PLN ^a	44 (22)	20 (28)	24 (19)	

Data are presented as number (percentage) unless otherwise indicated.

a 1 PLN = 0.23 EUR

Abbreviations: PCI, percutaneous coronary intervention

TABLE 2 Clinical characteristics of the study patients

Variable	All patients (n = 200)	Pre-PCI (n = 72)	Prior-PCI (n = 128)	P value
Duration of CAD, y, median (IQR)	6 (0.6–15)	0.5 (0.08–7)	10 (3–17)	0.001
History of 2 or more cardiac hospitalizations	94 (47)	10 (15)	84 (66)	0.001
History of MI	96 (48)	17 (24)	79 (62)	0.001
Diabetes mellitus	72 (36)	19 (26)	53 (41)	0.049
Hypercholesterolemia	164 (82)	51 (71)	113 (88)	0.02
Arterial hypertension	178 (89)	55 (76)	123 (95)	0.001
Family history of CAD	60 (30)	16 (23)	44 (34)	0.19
Early diagnosis of CAD (below the age of 55 in men and 65 in women)	102 (51)	27 (37)	75 (59)	0.003

Data are presented as number (percentage) unless otherwise indicated.

Abbreviations: CAD, coronary artery disease; IQR, interquartile range; MI, myocardial infarction; others, see TABLE 1

TABLE 3 Prevalence of risk factors for coronary artery disease in the study patients

Variable	All Patients (n = 200)	Pre-PCI (n = 72)	Prior-PCI (n = 128)	P value
Little physical activity (regular activity <150 min a week)	150 (75)	55 (76)	95 (74)	0.78
No cardiac rehabilitation	118 (59)	54 (76)	64 (50)	0.001
LDL cholesterol >1.8 mmol/l	114 (57)	51 (71)	63 (49)	0.02
Fasting glucose >5.5 mmol/l	86 (43)	33 (46)	53 (41)	0.61
SBP ≥140 mm Hg and / or DBP ≥90 mm Hg	84 (42)	30 (41)	54 (42)	0.9
Obesity (BMI ≥30 kg/m ²)	68 (34)	19 (26)	49 (38)	0.07
Current smoking	40 (20)	15 (21)	25 (19)	0.72

Data are presented as number (percentage).

Abbreviations: BMI, body mass index; DBP, diastolic blood pressure; LDL, low-density lipoprotein; SBP, systolic blood pressure; others, see TABLE 1

TABLE 4 Impact of factors other than a history of percutaneous coronary intervention on the level of knowledge and control of risk factors for coronary artery disease

Variable		Level of knowledge (max. 31)	P value	Level of risk control (max. 15)	P value
All patients		20 (12.5–24)	–	6 (4–7)	–
Age	<65 y	20 (13–24)	0.87	5 (4–6)	0.001
	>65 y	21 (12–24)		6 (5–8)	
Sex	Male	20 (15–24)	0.15	6 (4–7)	0.5
	Female	19 (8–23)		5 (4–7)	
Education	Primary, secondary, or vocational	19 (10–23)	0.002	5 (4–7.5)	0.58
	Higher	22 (19–24)		6 (5–7)	
Marital status	Married	20.5 (13–24)	0.66	6 (5–7)	0.1
	Not married	20 (12.5–23.5)		5 (4–6.5)	
Place of residence	Rural area	18 (10–22)	0.03	6 (5–7)	0.44
	City	21 (15–24)		5 (4–7)	
Net monthly household income	<4000 PLN ^a	19 (11–24)	0.001	6 (4–7)	0.37
	>4000 PLN ^a	22 (20–25)		5 (5–8)	
History of MI	Present	21 (15–24)	0.1	6 (5–8)	0.03
	Absent	19 (10–23)		5 (4–7)	
History of CABG	Present	21 (18–23)	0.13	7 (5–8)	0.006
	Absent	19 (11–24)		5 (4–7)	
Cardiac rehabilitation	Attended	21 (17–24)	0.06	7 (5–8)	0.001
	Not attended	20 (11–24)		5 (4–6)	
Hypertension	Present	20 (12–24)	0.27	6 (4–7)	0.72
	Absent	21 (15–24)		5 (4–8)	
Diabetes	Present	21 (15–24)	0.17	5 (4–7)	0.56
	Absent	19 (11–24)		6 (4–8)	
Cardiac consultations	Less often than every 6 months	21 (15–24)	0.54	5 (4–6)	0.01
	At least every 6 months	20 (13.5–24)		6 (5–8)	

Data are presented as median (interquartile range) number of points scored in the questionnaire.

a 1 PLN = 0.23 EUR

Abbreviations: CABG, coronary artery bypass grafting; others, see TABLE 2

the level of risk control in all patients ($R^2 = 0.15$; $\beta = -2.4$; $P = 0.001$) and in the prior-PCI group ($R^2 = 0.18$; $\beta = -2.8$; $P = 0.001$). No such impact was found for any particular type of rehabilitation. There was no association between the level of knowledge and the type of rehabilitation. The compliance to prescribed treatment was similar in both groups; 18% of patients in the pre-PCI group and 11% in the prior-PCI

group admitted forgetting about the treatment more frequently than once a month ($P = 0.17$). However, more patients in the pre-PCI group did not control blood pressure (28% in the pre-PCI group compared with 14% in the prior-PCI group, $P = 0.04$). No difference between the groups was observed in the frequency of visiting a general practitioner: 37% of the pre-PCI and 49% of the prior-PCI patients visited a general practitioner regularly every month ($P = 0.2$). Patients from the prior-PCI group consulted a cardiologist more often: 44% of the pre-PCI and 73% of the prior-PCI patients visited a cardiologist at least once in 6 months ($P = 0.001$). The frequency of visiting a general practitioner had no impact on both the level of knowledge ($P = 0.85$) and the level of risk factor control ($P = 0.11$).

We evaluated the impact of factors other than a history of PCI on the level of knowledge and the level of control of risk factors for CAD. The specific data are presented in TABLE 4. The analysis of Spearman rank correlation coefficient revealed that there was no correlation between the number of hospitalizations and the level of knowledge ($R^2 = 0.07$; $P = 0.38$). However, a weak correlation was found between the duration of CAD and the level of knowledge ($R^2 = 0.2$; $P = 0.03$). In addition, the actual level of patient knowledge correlated with the self-assessed level of knowledge ($R^2 = 0.36$; $P = 0.001$). Weak correlations were confirmed between the number of hospitalizations and the level of CAD risk control ($R^2 = 0.2$; $P = 0.002$) as well as between the duration of CAD and the level of risk control ($R^2 = 0.2$; $P = 0.003$). No association was found between the level of knowledge and that of risk control. However, there was a link between the self-assessed level of self-care and level of risk control ($R^2 = 0.2$; $P = 0.02$). The results of the multiple regression model assessing the impact of sociodemographic and clinical factors on the level of knowledge and risk control are presented in TABLE 5.

Asked about their previous education on CAD, 44% of patients in the pre-PCI group and 53% in the prior-PCI group reported receiving education during every previous hospitalization, whereas 25% of patients in the pre-PCI group and 13% in the prior-PCI group had not received any information before ($P = 0.06$). The median (IQR) quality rate of provided education assessed on a 5-point scale (1—worst quality, 5—best quality) was 3 (2–4) in the pre-PCI group and 4 (3–5) in the prior-PCI group ($P = 0.01$).

DISCUSSION The results of our study suggest that a change in patients' lifestyle and an increase in their knowledge after PCI are insufficient. Furthermore, not attending any form of rehabilitation lowers the level of risk control.

TABLE 5 Results of the multivariate regression analysis assessing the impact of risk factors for coronary artery disease on the level of knowledge and risk control in study patients

Dependent variable	Study group	R ²	Independent variable	β	P value
Level of knowledge	Pre-PCI	0.33	Number of hospitalizations	-1.30	0.2
			Duration of CAD	0.16	0.06
			Self-assessed level of knowledge	2.39	0.001
			Self-assessed level of self-care	-0.71	0.34
			Level of risk control	-0.24	0.59
	Prior-PCI	0.05	Number of hospitalizations	-0.07	0.74
			Duration of CAD	0.06	0.35
			Self-assessed level of knowledge	0.89	0.1
			Self-assessed level of self-care	-0.22	0.71
			Level of risk control	0.23	0.47
Level of risk control	Pre-PCI	0.15	Number of hospitalizations	0.06	0.85
			Duration of CAD	0.03	0.24
			Self-assessed level of knowledge	0.29	0.18
			Self-assessed level of self-care	0.39	0.1
			Level of knowledge	-0.03	0.59
	Prior-PCI	0.02	Number of hospitalizations	0.12	0.62
			Duration of CAD	0.12	0.58
			Self-assessed level of knowledge	0.11	0.37
			Self-assessed level of self-care	0.1	0.51
			Level of knowledge	0.1	0.47

Abbreviations: see TABLES 1 and 2

In recent decades, a rapid development in both pharmacological and invasive methods of treating CAD has been observed.⁹ Nevertheless, the results of the mortality follow-up in a series of the EUROASPIRE surveys indicate that cardiovascular risk factors remain independent predictors of mortality in patients with CAD.² It has been repeatedly demonstrated that the proper management of those risk factors, based on comprehensive secondary prevention programs, directly translates into a significant reduction in cardiac mortality and an improvement in the quality of life.^{10,11}

The EUROASPIRE IV survey, conducted among 7998 patients with CAD, highlighted the excessively high incidence of modifiable cardiovascular risk factors and their insufficient control, with 16% of the patients still smoking, 42.7% having poorly controlled hypertension, 37% being obese, 59.9% not meeting physical activity goals, 80.5% having poorly controlled low-density lipoprotein cholesterol levels, 26.8% having diabetes, and 58.8% not participating in any form of cardiac rehabilitation.^{2,12} Preliminary data from the EUROASPIRE V study are even more worrisome.¹³ At the same time, it has been shown that even

the standard education provided during hospitalization significantly improves patient awareness, and longer and more comprehensive education programs and cardiac rehabilitation can increase the effect.¹⁴⁻¹⁷ Of note, as many as 85% of the respondents in the latest European survey had a history of PCI.¹²

The introduction of PCI—with a shorter hospital stay, faster recovery, and frequent immediate relief of symptoms—improves short- to medium-term prognosis compared with coronary artery bypass grafting.³ However, the disease and its debilitating consequences can be underestimated by the patients.^{18,19} Furthermore, shorter hospitalization may reduce the time dedicated to in-hospital education. In our institution, patient education includes recommendations written on a discharge card and explanations provided by a doctor. Patients are also advised on other reliable sources of information, including online materials. However, lack of time and stress associated with hospitalization might result in poor compliance and low level of patient knowledge. In the SPICI study (Study of Patient Information after Percutaneous Coronary Intervention), 67% of the prior-PCI patients perceived themselves as

cured, and 38% believed that there was no need to modify their habits.¹⁸ Not surprisingly, undergoing PCI has been proved to be an independent predictor of nonattendance at cardiac rehabilitation and poor adherence to lifestyle changes.^{6,14,15,20} The quality of PCI in Poland complies with international standards and results in a decreased rate of in-hospital mortality due to acute coronary events in all age groups.^{21,22} However, 1-year mortality rate after discharge is as high as 10.1%, exceeding the European mean value.²³ The evidence on the quality of secondary prevention of CAD in Poland is rather scarce, while the available data suggest only a modest improvement in the implementation of the guidelines in recent years.^{7,23} Our findings are in line with the recent national and international surveys presenting a similar prevalence of modifiable risk factors for CAD.^{2,7,13,18}

The uptake of cardiac rehabilitation in our study was about 41% (24% in the pre-PCI group and 50% in the prior-PCI group), which is similar to data reported in the literature.^{2,7,13,18} As shown in the study conducted by Jankowski et al,²⁴ between 2010 and 2012 only 33.9% of patients hospitalized in southern Poland due to acute coronary syndrome or elective PCI declared that they had been advised to participate in cardiac rehabilitation or other secondary prevention programs, and as many as 90% from that group did eventually enroll. In a global analysis of cardiac rehabilitation accessibility, Poland is placed among countries with a wider variety of rehabilitation programs.^{7,17} However, the capacity of such programs might be limited.²⁵ Attending rehabilitation may also depend on other factors. For instance, Kimber et al²⁶ reported that patients with preoperative frailty are less likely to attend recommended rehabilitation. In recent years, promising results have been associated with the comprehensive coordinated care program after myocardial infarction (KOS-Zawał), introduced in 2017, that improved the treatment outcome in patients after myocardial infarction (MI) by increasing the accessibility of specialized care and cardiac rehabilitation. However, many patients included in our study had MI before 2017 or were treated in centers not participating in the KOS-Zawał program and therefore the effects of the initiative might not be present in these cases.²⁷ According to the guidelines, all patients with a history of acute coronary syndrome or invasive treatment should take part in a rehabilitation or secondary prevention program.⁸ We noted that not attending cardiac rehabilitation was negatively correlated with the level of risk factor control.

We found that both prior-PCI and pre-PCI patients had poor awareness of their CAD risk. The median knowledge score was 65% of correct answers, which showed gaps in many

aspects vital for patients with CAD. For instance, 70% of patients did not know when they can return to normal activity after MI, and 60% could not define the recommended blood pressure value. All modifiable CAD risk factors were identified by 11.5% of patients. As many as 75% of the patients did not reach the target level of physical activity and more than 1 in 20 patients were convinced that any form of physical activity is strictly contraindicated in their case. The results did not differ between the groups. This may indicate that the current models of education implemented prior to PCI and the timing of the intervention are inadequate and do not induce a recommended lifestyle change. Early education in a PCI center may be ineffective due to stress and patients' desire to return home as quickly as possible. On the other hand, postponing the intervention too much can be disadvantageous due to the fact that patients may return to their habits or lose motivation. Of note, a similar lack of relation between the duration and severity of the disease and its risk factors was also observed in other conditions such as aortic valve stenosis.²⁸

Limitations Some important limitations of our study should be considered. The main limitation was the unstandardized questionnaire used in the assessment of patient knowledge and risk control levels. However, we still lack standardized methods for such evaluation and experience obtained from every study investigating that issue may help create normalized tools that could be used in further research to provide comparable results. Another important limitation is the heterogeneous patients' clinical characteristics, also present for factors influencing the level of knowledge and risk control, such as the prevalence of MI or duration of CAD. However, the heterogeneity depicts a comprehensive profile of patients in each group that influences the clinical outcome and it is difficult to assess particular factors in isolation. Furthermore, our study is based on a single-center experience. Therefore, further multi-center trials are still needed to fully assess the complex factors that affect patients' attitude towards lifestyle modifications in CAD.

Conclusions Patients have poor knowledge and awareness of their CAD risk regardless of having a history of revascularization. No difference in the levels of knowledge and risk control was observed between the pre- and prior-PCI groups. There is a considerable need for an in-depth revision of secondary prevention of CAD, especially in the prior-PCI population, aimed to improve patients' understanding of the disease and compliance to the cardioprotective lifestyle.

SUPPLEMENTARY MATERIAL

Supplementary material is available at www.mp.pl/kardiologiapolska.

ARTICLE INFORMATION

CONFLICT OF INTEREST None declared.

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