Analysis of the rate of restenosis in patients with acute coronary syndrome without ST elevation and concomitant diabetes mellitus type 2 according to the kind of stent

Analiza częstości występowania restenozy u chorych z ostrym zespołem wieńcowym bez uniesienia odcinka ST i ze współistniejącą cukrzycą w zależności od rodzaju implantowanego stentu

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Abstract

Background: Acute coronary syndrome without ST segment elevation (NSTEMI) in patients with diabetes mellitus (DM) has poor prognosis and percutaneous coronary intervention (PCI) is the best treatment strategy. However, there are no clear guidelines concerning the choice of optimal invasive treatment strategy.

Aim: To evaluate the restenosis rate in patients with NSTEMI and DM depending on the kind of implanted stent.

Material and methods: The study group comprised 984 NSTEMI patients hospitalized in the 2nd Department of Cardiology. 352 patients received a bare metal stent (BMS), while 632 pts received a drug-eluting stent (DES) – 238 pts a paclitaxel-eluting stent (PES) and 394 a sirolimus-eluting stent (SES). There were no statistically significant differences concerning age of the groups.

Results: After 1-year follow-up there were no significant mortality differences – 7.9% in the BMS group, 8.8% in the PES group and 8.1% in the SES group. There were 6 in-hospital deaths, one in the BMS and PES groups and 4 in the SES group. After 1-year follow-up there were significant restenosis rate differences: 8.24% in the BMS group, 8.4% in the PES group and 6.34% in the SES group (p = 0.003). Stent thrombosis was a rare complication and occurred in 10 patients without differences in stent groups. The predictors of restenosis revealed by univariate logistic regression analysis included female gender, lipid disturbances ($p < 0.001$), past myocardial infarction ($p < 0.001$) and peripheral arterial disease ($p < 0.001$).

Conclusions: Percutaneous coronary angioplasty in patients with NSTEMI and coexisting DM is effective and safe. Implantation of sirolimus-eluting stents gives the best long-term results expressed as the lowest restenosis rate.

Key words: acute coronary syndrome without ST segment elevation, diabetes mellitus, percutaneous coronary intervention, bare metal stent, drug-eluting stent

Streszczenie

Wstęp: Ostry zespół wieńcowy bez uniesienia odcinka ST (ang. *non ST elevation myocardial infarction*, NSTEMI) u pacjentów ze współistniejącą cukrzycą obarczony jest gorszym rokowaniem, a leczenie pierwotną angioplastyką okazuje się najkorzystniejszą metodą leczniczą. Mimo wielu badań poświęconych leczeniu chorych z NSTEMI, nie ma szerszych opracowań dotyczących wyboru strategii leczenia inwazyjnego osób z NSTEMI i towarzyszącą cukrzycą.

Cel: Analiza częstości występowania restenozy w zależności od rodzaju implantowanego stentu.

Materiał i metody: Badaniem objęto kolejnych 984 chorych hospitalizowanych w Klinice Kardiologii z powodu NSTEMI ze współistniejącą cukrzycą. Stent metalowy (ang. *bare metal stent*, BMS) miało wszczepiony 352 chorych, a 632 – stent uwalniający lek, w tym 238 pokryty paklitakselem (ang. *paclitaxel eluting stent*, PES), a 394 sirolimusem (ang. *sirolimus eluting stent*, SES). Nie stwierdzono różnic dotyczących średniej wieku osób w grupach leczonych przezskórną angioplastyką wieńcową (ang. *percutaneous coronary intervention*, PCI), które otrzymały BMS.

Wyniki: W obserwacji szpitalnej odnotowano łącznie 6 zgonów, w tym po 1 w grupach osób z BMS i PES oraz 4 w grupie osób z SES. Podczas rocznej obserwacji śmiertelność nie różniła się w poszczególnych grupach i wynosiła 7,9% w grupie osób z BMS, 8,8% w grupie osób z PES i 8,1% w grupie osób z SES. W obserwacji rocznej odsetek chorych z nawrotem zwężenia w grupie z implanto-

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wanym BMS wynosił 8,24%, a z PES 8,4%. Zwraca uwagę rzadziej występująca restenoza w grupie osób z implantowanym SES (6,34%, p = 0,003). Zakrzepica w stencie zdarzała się stosunkowo rzadko i obserwowano ją łącznie u 10 chorych w podobnym odsetku w grupie osób z BMS, PES i SES. W analizie rocznej i odległej czynnikami ryzyka wystąpienia restenozy okazały się płeć żeńska, zaburzenia lipidowe (p < 0,001), przebyty zawał serca (p < 0,001) oraz choroba naczyń obwodowych (p < 0,001).

Wnioski: Przezskórna angioplastyka wieńcowa jest skuteczną i bezpieczną metodą rewaskularyzacji chorych z NSTEMI i współistniejącą cukrzycą. Analiza materiału w obserwacji rocznej nie wykazała istotnej przewagi PES nad BMS. Istotne statystycznie różnice wykazano dla SES, natomiast w obserwacji odległej zaznaczyła się wyraźna przewaga stentów uwalniających leki wyrażająca się znacznie mniejszą częstością występowania restenozy w tych grupach pacjentów.

Słowa kluczowe: ostry zespół wieńcowy bez uniesienia odcinka ST, cukrzyca typu 2, angioplastyka wieńcowa, klasyczne stenty metalowe, stenty uwalniające leki

Introduction

Patients with diabetes mellitus (DM) have more advanced changes in the coronary arteries and more frequent presence of multivessel disease affecting two or more arteries, including the left main coronary artery [1]. For that reason, surgical revascularization was considered as the method of choice in this group of patients. The efficacy of percutaneous coronary intervention (PCI) procedures may be limited by a high rate of restenosis, difficulties in obtaining full revascularization of the ischaemic area and/or fast progression of atherosclerosis in vessels treated with angioplasty and in other vessels [2]. Patients with diabetes have a higher risk of restenosis, particularly in the long-term observation. Therefore the correct choice of stent is an important issue. Results of the RAVEL and SIRIUS trials confirmed a decrease of the restenosis rate (0-16%) for the rapamycin-coated stent in the subgroup of patients with DM in comparison to 42-51% observed after implantation of bare metal stents [3, 4]. Similar benefits of treatment in patients with DM were demonstrated with the use of paclitaxel-coated stents in the TAXUS trial [5]. The question is whether the choice of stent (bare metal [BMS] or drug-eluting) influences the long-term prognosis and particularly mortality or restenosis rate in high risk patients, such as those with coexisting diabetes.

Aim

The aim of the study was to analyse the frequency of restenosis in one-year and long-term observation according to the type of implanted stent.

Material and methods

The analysis included 984 consecutive patients with diabetes hospitalized in the Department of Cardiology due to acute coronary syndrome without persistent ST-segment elevation who were treated with primary angioplasty. More detailed data are presented in table 1. All patients met the following inclusion criteria:
– the presence of electrocardiogram (ECG) changes on admission such as ST-segment depression in more than one lead or dynamic of ST-segment changes,

Table 1. Analysis of patients who underwent PCI – clinical data
Tabela 1. Analiza chorych poddanych PCI – dane kliniczne

Type of stent	BMS 352	PES 238	SES 394	Value of p
Age [years]	60.4 [55.2, 68]	59.2 [54.7, 69.5]	61.2 [54.7, 70.5]	> 0.05
Sex (male %)	59.0% (208/352)	65.1% (155/238)	61.2% (241/394)	> 0.05
BMI [kg/m^2]	28.1 (26.8, 30.1)	25.5 (24.2, 29.2)	27.7 (25.0, 31.2)	> 0.05
History of myocardial infarction [%]	9.5 (34/352)	10.0 (24/238)	9.6 (38/394)	> 0.05
Hypertension [%]	48.0 (169/352)	49.6 (118/238)	48.2 (190/394)	> 0.05
Dyslipidaemia [%]	38.0 (134/352)	47.0 (112/238)	39.6 (156/394)	> 0.05
Smoking [%]	36.4 (128/352)	40.3 (96/238)	40.8 (161/394)	> 0.05
Diabetes treated with insulin [%]	30.96% (109/352)	33.61% (80/238)	32.48% (128/394)	> 0.05
Glycated haemoglobin level (HbA$_{1c}$)	7.6 ±2.1	7.0 ±1.9	7.4 ±2.2	> 0.05
Renal failure GFR < 60 ml/min	3.98% 14/352	3.4% 8/238	3.55% 14/394	> 0.05
Previous PCI or CABG [%]	9.65 (34/352)	9.82 (21/238)	9.98 (39/394)	> 0.05
Heart failure % NYHA class III or more	2.27 (8/352)	2.94 (7/238)	2.53 (10/394)	> 0.05
Peripheral arterial disease [%]	3.97 (14/352)	4.62 (11/238)	3.04 (12/394)	> 0.05
Ejection fraction < 45% [%]	21.02 (74/352)	19.32 (46/238)	21.31 (84/394)	> 0.05

– increased concentration of myocardial necrosis markers – troponin or CK-MB,
– the presence of diabetes diagnosed before admission or during hospitalization with routinely used laboratory methods.

All patients underwent coronary angiography and echocardiographic examination with the assessment of ejection fraction (EF) and the degree of contraction abnormalities.

Three hundred and fifty-two patients received a bare metal stent and 632 had a drug-eluting stent implanted (paclitaxel coated [PES] in 238 cases and sirolimus coated [SES] in 394 cases). After discharge patients remained under ambulatory follow-up.

Statistical analysis

All qualitative data are presented as absolute numbers and percentages. Continuous variables are presented as means or medians. The data distribution is presented as the standard deviation with minimal and maximal values provided.

Statistical analysis of the studied variables was based on the parametric and non-parametric tests. Analysis of the empirical distributions of studied parameters was performed using the Shapiro-Wilk W test. The Kruskal-Wallis test was performed to compare the control group and studied groups. The following non-parametric tests were applied to verify the hypothesis that two qualitative features in the population are independent:
– χ^2 Pearson's test for qualitative variables,
– χ^2 test with Yates' correction,
– Fisher's exact test [7].

All calculations were performed using Statistica ver. 8.0 PL.

Results

Table 1 shows that groups of patients who received BMS, PES or SES were similar in relation to age, percentage of men, risk factors, the frequency of ejection fraction below 45% and the frequency of coexisting peripheral arterial disease or previous surgical or percutaneous revascularization.

There was no difference in age between the PCI groups (BMS/PES/SES). The percentage of men was similar (between 59% and 65.1%) and this sex predominated in all groups.

The prevalence of other risk factors such as hypertension, dyslipidaemia, and previous myocardial infarction was also comparable. The percentage of smokers was high in all groups and varied between 36.4% and 40%, with the highest proportion observed in patients with SES. However, this difference was not statistically significant. Other clinical parameters were also similar: the percentage of patients on insulin, glycated haemoglobin level (HbA_{1c}) or renal failure.

Data regarding PCI procedures are presented in table 2. The procedure was performed immediately after coronary angiography in approximately 90% of patients in all analysed groups. In most cases, only one vessel was treated (mean 1.03 to 1.08 vessels). TIMI flow 0/1 before PCI was present in almost 70% of patients. TIMI III flow after PCI was observed in 90% of patients.

The degree of stenosis was highest in the SES group (97%) in comparison to the PES group (88.2%) and BMS group (92.8%) ($p < 0.05$). The reference vessel diameter was highest in the BMS group (2.98) and lowest in the PES group (2.73); $p < 0.05$. GP IIb/IIIa inhibitors and heparin were used in a similar percentage of patients before the

Table 2. Data regarding interventional treatment (PCI)
Tabela 2. Dane dotyczące leczenia zabiegowego (PCI)

Type of stent	BMS 352	PES 238	SES 394	Value of p
Procedure immediately after coronary angiography	94.3 (332)	89.0 (212)	94.4 (376)	> 0.05
Number of treated vessels (mean)	1.08	1.03	1.06	> 0.05
TIMI flow before PCI TIMI 0/I	69.9 (246)	58.0 (138)	68.8 (271)	> 0.05
TIMI II	18.2 (64)	25.6 (61)	20.8 (82)	> 0.05
TIMI III	11.9 (42)	16.4 (39)	10.4 (41)	> 0.05
Reference diameter of the vessel	2.98 (2.55-3.45)	2.73 (2.47-3.18)	2.88 (2.55-3.22)	< 0.05
Degree of stenosis [%]	92.8 (75.0-100.0)	88.8 (74.0-100.0)	97.0 (76.9-100.0)	< 0.05
Number of implanted stents	1.09	1.07	1.04	> 0.05
Length of implanted stent/stents	22.0 (10-24)	25.0 (10-32)	24.6 (10-33)	> 0.05
Heparin administered before the procedure [%]	50.5	50.5	54.4	> 0.05
300 mg clopidogrel dose before PCI [%]	32	28	31	> 0.05
600 mg clopidogrel dose before PCI [%]	68	72	69	> 0.05
Use of GP IIb/IIIa inhibitors [%]	27	26	28	> 0.05
TIMI III after PCI	92 (324)	93 (221)	90.1 (358)	> 0.05

procedure. There were also no significant differences in the frequency of clopidogrel loading with 300 mg and 600 mg.

Data regarding the procedure and in-hospital observation are illustrated in table 3. There were 6 deaths during hospitalization including 1 in the BMS group, 1 in the PES group and 4 in the SES group. Local bleeding complications requiring surgical intervention or blood transfusion were quite frequent. The frequency of those complications was significantly lowest in the SES group.

One-year observation

One-year observation demonstrated similar mortality between studied groups (7.9% in the BMS group, 8.8% in the PES group and 8.1% in the SES group), as demonstrated in table 4. Notably there was a lower restenosis rate in the SES group – 6.34% ($p = 0.003$). Stent thrombosis was relatively infrequent – it occurred in 10 patients and the rate was similar in the BMS, PES and SES group.

One-year analysis of patients with restenosis (tab. 5) demonstrated a higher proportion of women (55.4%, $p < 0.001$), higher frequency of dyslipidaemia (56.76%, $p < 0.001$) and previous myocardial infarction (41.89% vs. 8.16%, $p < 0.001$), higher prevalence of heart failure NYHA class III (9.46% vs. 1.96%, $p < 0.001$), and more diffuse atherosclerosis as expressed by higher prevalence of

peripheral arterial disease (21.62% vs. 2.29%, $p < 0.001$). Other risk factors such as smoking were also more frequent in this group of patients (58.11% vs. 37.21%, $p < 0.01$).

Interestingly, there was no difference in the restenosis rate between BMS and PES in 1-year observation (8.24% vs. 8.4%), but there was a difference in the SES group (6.34%), $p = 0.003$ – figure 1.

It should be noted that female sex was a risk factor of restenosis at 1 year. The restenosis rate was 10.8% in women and 5.46% in men, which was statistically significant ($p < 0.001$, odds ratio 1.98) – figure 2.

Long-term observation

The mean time of observation in each group exceeded 3.5 years and was longest in the BMS group – 4.46 years (maximally 10 years) (tab. 6). Mortality in the BMS group was 16.8%, in the PES group 19.3% and in the SES group 15.9%, which was not statistically significant. Angiographically proven restenosis was documented in 18.75% of patients in the BMS group, 12.18% in the PES group and 11.42% in the SES group.

Restenosis was noted in 140 patients in the long-term observation (tab. 7). Risk factors predisposing to a late recurrence of stenosis were analysed. As in 1-year observation, patients with restenosis were more likely to have previous myocardial infarction (30% vs. 5.45%, $p < 0.001$), heart failure (15% vs. 0.47%, $p < 0.001$), renal failure (21.43%

Table 3. Data regarding effectiveness of interventional treatment (PCI) – in-hospital observation
Tabela 3. Dane dotyczące skuteczności leczenia zabiegowego (PCI) – obserwacja wewnątrzszpitalna

| Type of stent	BMS 352	PES 238	SES 394	Value of p
TIMI III after PCI	92 (324/352)	93 (221/238)	90.1 (358/394)	> 0.05
Periprocedural myocardial infarction	0.57% (2/352)	1.26% (3/238)	1.27% (5/394)	> 0.05
Local complications requiring surgical intervention or blood transfusion	10/352	7/238	12/394	> 0.05
Local complications treated conservatively	5.96%[x] (21/352)	6.72%[x] (16/238)	3.04%[x] (12/394)	< 0.05
Cardiovascular death	0/352	1/238	2/394	> 0.05
Non-cardiovascular death	1/352	0/238	2/394	> 0.05

Table 4. One-year observation of the patients treated with PCI
*Tabela 4. Obserwacja roczna chorych leczonych metodą PCI*

Type of stent	BMS 352	PES 238	SES 394	Value of p
Lack of data	9	8	7	> 005
Composite end-point MACE	22.4% (79/352)	25.6% (61/238)	23.0% (91/394)	> 0.05
Mortality	7.9% (28/352)	8.8% (21/238)	8.1% (32/394)	> 0.05
Myocardial infarction	22/352	16/238	28/394	> 0.05
Cardiovascular death	21/352	16/238	23/394	> 0.05
Non-cardiovascular death	7/352	5/238	9/394	> 0.05
Repeated coronary angiography	29/352	24/238	31/394	> 0.05
Stroke	1/352	0/238	2/394	> 0.05
Restenosis	8.24% (29/352)	8.4% (20/238)	6.34% (25/394)	< 0.001
Stent thrombosis	0.85% (3/352)	1.26% (3/238)	1.01% (4/394)	> 0.05

Table 5. Risk predictors of restenosis in one-year observation
Tabela 5. Czynniki predykcyjne wystąpienia restenozy w obserwacji rocznej

Parameters	Restenosis present ($n = 74$)	Percentage	Restenosis absent ($n = 910$)	Percentage	Significance (value of p)
Age [years]	58.3 ±5.1	–	61.1 ±7.1	–	NS
Women	41	55.4	320	35.16	< 0.001
Men	33	44.59	590	64.83	< 0.01
Hyperlipidaemia	42	56.76	360	39.17	< 0.001
Hypertension	26	35.14	451	49.08	< 0.05
Smoking	43	58.11	342	37.21	< 0.01
Previous myocardial infarction	31	41.89	75	8.16	< 0.001
Heart failure NYHA class III	7	9.46	18	1.96	< 0.001
Renal failure	13	17.57	23	2.50	< 0.001
Peripheral arterial disease	16	21.62	21	2.29	< 0.001
Previous PCI	31	41.89	63	6.86	< 0.001
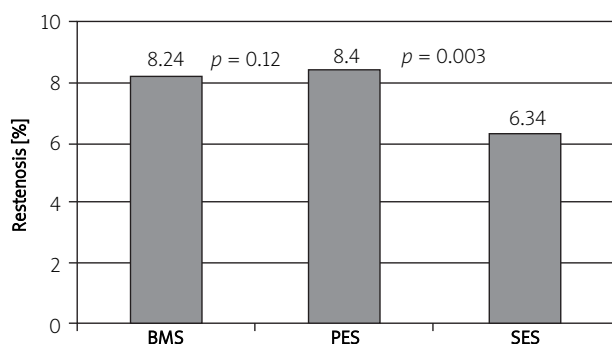
Fig. 1. Restenosis rate according to the type of implanted stent in one-year observation
Ryc. 1. Częstość występowania restenozy w obserwacji rocznej w zależności od rodzaju implantowanego stentu
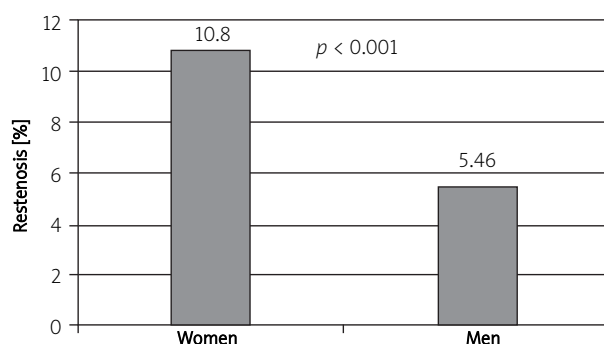
Fig. 2. Restenosis rate according to sex in one-year observation
Ryc. 2. Częstość występowania restenozy w obserwacji rocznej w zależności od płci

Table 6. Long-term observation of patients treated with PCI
Tabela 6. Obserwacja odległa chorych leczonych metodą PCI

Type of stent	BMS 352	PES 238	SES 394	Value of p
Remaining in observation	268/352	170/238	290/394	> 0.05
Mean time of observation	4.46	3.64	3.72	< 0.001
Mortality	16.8% (59/352)	19.3% (46/238)	15.9% (63/394)	> 0.05
Myocardial infarction	29/352	17/238	37/394	> 0.05
Cardiovascular death	27/352	16/238	29/394	> 0.05
Non-cardiovascular death	32/352	30/238	34/394	> 0.05
Repeated coronary angiography	56/352	42/238	57/394	> 0.05
Stroke	2.0% (7/352)	5.04% (12/238)	4.31% (17/394)	> 0.001
Angiographically proven restenosis	18.75% (66/352)	12.18% (29/238)	11.42% (45/394)	< 0.001

vs. 0.71%, $p < 0.001$), peripheral arterial disease (20% vs. 1.07%, $p < 0.001$) or repeated revascularizations (28.57% vs. 6.4%, $p < 0.001$). Dyslipidaemia was also more frequent in patients with late restenosis but this difference was less evident than in 1-year observation. There was no difference in the prevalence of hypertension and smoking.

It should be noted that there was a significant difference between the frequency of restenosis in women

Table 7. Risk predictors of restenosis in the long-term observation
Tabela 7. Czynniki predykcyjne wystąpienia restenozy w obserwacji odległej

| Parameters	Restenosis present (n = 140)	Percentage	Restenosis absent (n = 844)	Percentage	Significance (value of p)
Age [years]	58.7		61.1		
Women	82	58.57	298	35.31	< 0.01
Men	58	41.43	546	64.69	< 0.01
Hyperlipidaemia	81	57.86	321	38.03	< 0.01
Hypertension	52	37.14	325	38.51	NS
Smoking	65	46.43	320	37.91	NS
Previous myocardial infarction	42	30.00	46	5.45	< 0.001
Heart failure NYHA class III	21	15.00	4	0.47	< 0.001
Renal failure	30	21.43	6	0.71	< 0.001
Peripheral arterial disease	28	20.00	9	1.07	< 0.001
Previous PCI	40	28.57	54	6.40	< 0.001

and men (21.58% in women and 9.6% in men – OR 2.25, $p < 0.001$) (fig. 3).

The restenosis rate was highest in patients with an implanted BMS (18.85%) and lower in those with an implanted drug-eluting stent (12.18% in the PES group and 11.42% in the SES group). The difference between patients with implanted BMS and drug-eluting stents was statistically significant. No differences were noted between drug-eluting stents (tab. 8, fig. 4). The frequency of restenosis was significantly higher in patients with BMS in comparison to patients with drug-eluting stents (18.75% vs. 12.18% vs. 11.42%, $p < 0001$). There was no significant difference between both types of drug-eluting stents (12.8% vs. 11.42%, $p < 0.08$).

Discussion

There are varying opinions regarding the choice of stent in NSTEMI patients with coexisting diabetes. However, as demonstrated by recently published studies and registries, most operators prefer DES [8-10]. It is accepted that implantation of DES is indicated primarily in patients at high risk (such as diabetic patients) and that those patients
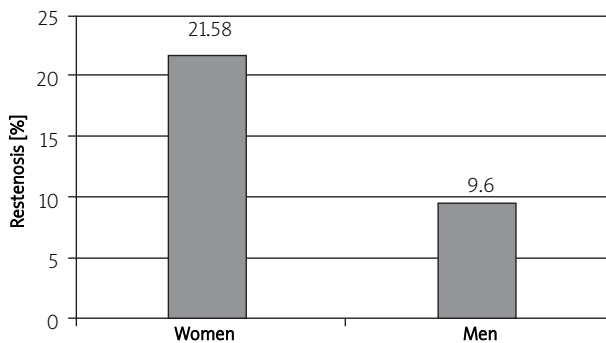
Fig. 3. Restenosis rate according to sex in the long-term observation
Ryc. 3. Częstość występowania restenozy w obserwacji odległej w zależności od płci
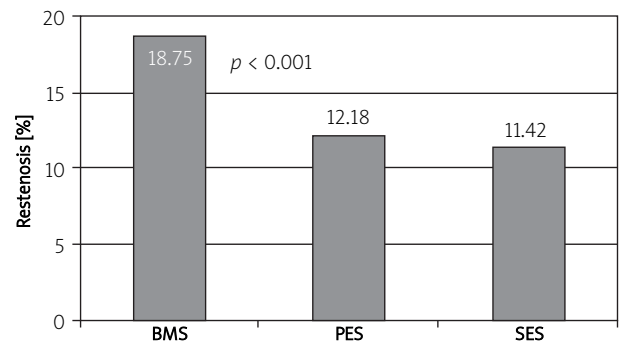
Fig. 4. Restenosis rate according to the type of implanted stent in the long-term observation
Ryc. 4. Częstość występowania restenozy w obserwacji odległej w zależności od rodzaju implantowanego stentu

Table 8. Restenosis rate according to the type of stent in the long-term observation
Tabela 8. Odsetek restenoz w zależności od rodzaju stentu w obserwacji odległej

Stent	Restenosis present	Percentage	Restenosis absent	Percentage	Value of p
BMS (352)	66	18.75	312	81.25	< 0.001
PES (238)	29	12.18	209	87.82	< 0.001
SES (394)	45	11.42	340	88.58	< 0.001

benefit more in terms of for example lower restenosis rate [11]. In our material, 1-year mortality was comparable in BMS and DES groups and did not exceed 10% in any group.

The first analyses regarding the risk of restenosis in long-term observation in patients with implanted drug-eluting stents were published approximately 6 years ago. The rate of restenosis was similar in the analysis of Corbertt *et al.*, who studied cases of restenosis in 803 patients with sirolimus-eluting stents and in 1199 patients with paclitaxel-eluting stents after a mean of 1.5 years of observation [12]. There was a significant proportion of patients with diabetes in both compared groups (30.6% for SES and 26.8% for PES). The authors performed an angiographic analysis of all patients and defined restenosis as more than 50% reduction of the vessel lumen in relation to the initial lumen diameter assessed directly after stent implantation in the stented area as well as 5 mm proximally and distally to the stent. Restenosis was observed in a relatively high proportion of patients – in 17.4% of those with an implanted PES and less frequently (15.9%) in those with an implanted SES ($p = 0.509$). Detailed angiographic analysis demonstrated that patients with an implanted PES have a significantly higher rate of diffuse restenosis, causing occlusion of the stented vessel (47.6%) in comparison to 27.0% of those with an implanted SES ($p < 0.001$). Multivariable analysis demonstrated that diffuse restenosis occurred more frequently in women (odds ratio OR = 3.994, $p = 0.003$). Female sex was the strongest predictive factor of diffuse restenosis. The type of stent (PES) was the second strongest factor (OR = 2.693, $p = 0.002$). Also in our material female sex was a significant risk factor of restenosis. The differences were evident and regarded higher mortality and restenosis rate. This could have been influenced by many factors including anatomical conditions – smaller vessel lumen, higher vessel tortuosity, which could affect stent positioning, and efficacy of treatment.

The SCAAR registry including PCI procedures performed in Sweden between 2004 and 2008 comprised all patients who underwent invasive treatment in 26 large centres during that period [13]. The authors analysed 19 004 patients, in whom 35 478 stents were implanted during 22 962 PCI procedures. There were 8 231 patients with diabetes in that group. The observation period for all patients was 2 years. Restenosis was defined as the presence of haemodynamically significant stenosis in patients undergoing repeated angiography due to the presence of clinical symptoms. The authors divided patients into 4 groups according to the type of implanted stent. Two groups included patients who underwent paclitaxel-eluting stent implantation (Taxus Express and Taxus Liberte) and the two other groups comprised patients who received sirolimus-coated stents (SES – CYPHER) or stents coated with a compound of similar action – zotarolimus (ENDEAVOR). In all patients (including those with and without DM) implantation of a zotarolimus-eluting stent led to a higher restenosis rate in comparison to other stents. The difference in restenosis rate was almost 2-fold in patients with DM and about 20-30% in patients without DM in comparison to SES or PES. Notably, there was a relatively low difference in restenosis rate between patients with and without diabetes – 10% vs. 8.9% in 2-year observation – which are considerably different results from the results of other authors cited before. According to the authors, this difference might have been caused by an atypical course of coronary artery disease in patients with DM, who often do not have typical clinical symptoms used as the qualification criterion for a control coronary angiography. There were also no statistically significant differences in the frequency of restenosis in relation to the type of diabetes treatment (insulin vs. oral drugs).

It remains an open question whether there is a type of drug-eluting stent which would be particularly indicated in patients with DM. So far there is no unequivocal proof in clinical trials demonstrating superiority of any type of drug-eluting stents in patients with diabetes in the long-term observation. Most of the studies emphasize the superiority of drug-eluting stents over classic BMS. The results of the SIRIUS trials comparing the sirolimus-eluting stent and classic BMS after 9 months of observation in a subgroup of patients with diabetes showed a 17.6% restenosis rate in the case of SES and an almost 3-fold higher one (50.5%) in the case of BMS implantation ($p < 0.001$) [14]. There was also a 63% reduction of serious cardiac events in the SES group in comparison to the BMS group (9.2% vs. 25%, $p < 0.001$) after 270 days of observation. The TAXUS IV trial, which included 32% of patients with diabetes, compared the clinical and angiographic efficacy of treatment with paclitaxel-eluting stents or bare metal stents [15].

Angiographically proven restenosis was noted in 42.9% of diabetic patients treated with BMS and only in 7.7% of diabetic patients who received PES ($p = 0.007$). Those studies arguably defined indications for drug-eluting stent implantation in patients with diabetes. However, it should be noted that both studies included clinically stable patients.

Can similar benefits be observed in the case of acute coronary syndromes? Our analysis demonstrated similar restenosis rates at 1 year in patients treated with BMS and PES (8.24% vs. 8.4%, $p = 0.12$) and lower frequency of restenosis in patients who received SES (6.34%). However, more evident differences in the frequency of restenosis according to the type of implanted stent were noted in the long-term observation. Restenosis occurred more often in patients with BMS (18.75%) in comparison to those who received PES (12.18%) or SES (11.42%) ($p < 0.001$).

A notable fact confirmed in one-year and the long-term observation was a higher frequency of restenosis in

women. During one year of observation in our group, restenosis occurred in 10.8% of women and in 5.46% of men ($p < 0.0001$). This phenomenon persisted and even increased in the long-term observation (21.58% vs. 9.6%, $p < 0.001$). This sex disequilibrium phenomenon was also confirmed by other researchers.

Risk factors predisposing to restenosis in one-year and the long-term observation included previous myocardial infarction, previous percutaneous revascularization, heart failure and renal failure as well as dyslipidaemia and peripheral arterial disease. Interestingly, in our group smoking was not a factor predisposing to restenosis in the long-term observation, which makes our results different from the results of other authors who demonstrated a negative influence of chronic smoking on the long-term prognosis (both in terms of higher risk of restenosis and mortality) [16]. This may be caused by the fact that the majority of patients refrained from smoking after PCI and had better blood pressure control after introduction of effective pharmacotherapy. On the other hand, renal failure and advanced heart failure (NYHA class III) had a significant influence on mortality and restenosis rate. The importance of those factors in the progression of restenosis was also emphasized by other authors [17, 18]. Coexistence of peripheral arterial disease indicating more advanced atherosclerosis was another risk factor of death or restenosis.

Conclusions

Percutaneous coronary intervention is an effective and safe method of revascularization in patients with acute coronary syndrome without ST-segment elevation (NSTEMI) and with coexisting diabetes. The use of this method as a primary choice in this population of patients is justified by a high reperfusion rate (over 90%) and a relatively low frequency of restenosis. Analysis of our material did not show a significant advantage of PES over BMS in 1-year observation. However, significant differences for SES were found. There was a marked advantage of drug-eluting stents in the long-term observation, as demonstrated by a significantly lower restenosis rate. Factors predisposing for restenosis were previous myocardial infarction, previous percutaneous revascularization, renal failure, heart failure and peripheral arterial disease.

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