

Temporal trends and patterns in percutaneous treatment of coronary artery disease in Poland in the years 2005–2011

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Abstract

Background: According to a recent survey, Poland is one of the leaders of interventional cardiology in Europe in terms of the number of primary percutaneous coronary intervention (PCI) procedures per million inhabitants.

Aim: To present temporal trends in epidemiology, demographics, treatment, and periprocedural outcome of patients referred for percutaneous coronary angiography and angioplasty in Poland in 2005–2011, based on the Polish National PCI Registry.

Methods: Patients who underwent percutaneous coronary angiography (ANGIO group) and/or angioplasty (PCI group) were included in the Polish National PCI Registry — a prospective observational registry study in Poland.

Results: There were 935,429 patients in the ANGIO group and 501,117 in the PCI group in Poland in 2005–2011. The number of catheterisation labs increased from 75 to 137, angiography procedures rose from 99,195 to 180,935, and PCIs from 50,297 to 99,614. The procedural mortality and stroke rates for the ANGIO group have remained stable whereas for the PCI group procedural mortality has increased over the years. The use of drug eluting stents (DESs) rose from 32.8% to 55.3% in stable angina and the use of a radial approach from 26.8% to 39.1%.

Conclusions: Use of modern attributes of interventional cardiology like DES stents, radial approach, and treatment of higher risk patients has increased in Poland in 2005–2011. The adoption of the “Stent for Life” initiative has resulted in an increasing number of percutaneous coronary procedures over the years.

Key words: angiography, angioplasty, coronary artery disease, epidemiology

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INTRODUCTION

Guidelines from the European Society of Cardiology (ESC) advocate quality control for revascularisation procedures [1]. Only high-quality long-term registries of consecutive patients may provide adequate control over the whole spectrum of percutaneous coronary interventions (PCI) in invasive cardiol-

ogy centres. Multiple high-number international registries have researched outcomes mainly in patients with acute coronary syndromes [2–4]. It seems, however, that a more tailored approach for local assessment is required since regional differences still exist even though the “Stent for Life” initiative has been widely promoted across ESC member states [3, 5, 6].

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National registries like SWEDHEART, PL-ACS, AMIS, and MITRA provide answers adequate for local conditions and demographics [7–10].

According to a recent survey, Poland is one of the leaders of interventional cardiology in Europe in terms of the number of primary PCI procedures per million inhabitants [5]. This has been the main trigger to analyse Polish data separately. In Poland, there are currently two ongoing national registries: PL-ACS (including the whole spectrum of acute coronary syndrome patients both treated invasively and non-invasively) and the Polish National PCI Registry (only patients treated with percutaneous interventions) [8]. Annual reports from the latter are published each year by the Polish Association of Cardiovascular Interventions of the Polish Cardiac Society [11, 12].

The aim of this study is to present temporal trends and patterns in epidemiology, demographics, treatment, and periprocedural outcome of patients referred for percutaneous coronary angiography and angioplasty in Poland in 2005–2011, based on the Polish National PCI Registry.

METHODS

Polish National PCI Registry is a prospective observational registry study that enrolls all consecutive patients in cardiac catheterisation laboratories in Poland since 2004. From 2004 until 2013 data were entered using a dedicated application installed on a computer in each cathlab. Since 2014 data have been entered using an electronic case-report form via a webpage (<https://www.orpki.cm-uj.krakow.pl/>). The registry is endorsed by the Polish Association of Cardiovascular Interventions of the Polish Cardiac Society. For the purpose of this

analysis, data from 2005 up to 2011 are presented because the data for the year 2004 were incomplete. In 2009 the database underwent a major revision and some items were removed while others were redefined or included for the first time. Data that were incoherent for 2005–2008 vs. 2009–2011 were presented partially. There were 75 cathlabs enrolling patients in the registry in Poland in 2005, which increased to 137 in 2011. Patients who underwent percutaneous coronary angiography (ANGIO group) and/or angioplasty (PCI group) were included in the registry. Data on demographics, past medical history, and clinical status were analysed. Only periprocedural outcome and procedural success were reported. The data in the registry were not validated by independent monitors or institutions, nor were they checked for consistency with source data documentation. They are based on the input provided from participating centres to the database. The registry protocol complied with the Declaration of Helsinki (with later amendments).

Statistical methods

Data were analysed according to established statistical standards. Categorical variables were presented with counts and as percentages (%) and continuous variables as medians (with inter-quartile range). The equality of two or more continuous distributions was determined by the Kruskal-Wallis test. The independence of two categorical variables was determined by the Pearson χ^2 test or in the case of small counts by the Fisher exact test. No correction for multiple testing was applied. A p value of less than 0.05 was considered to be statistically significant. All data processing and statistical calculations were performed in R 2.13 by an experienced statistician (K.F.).

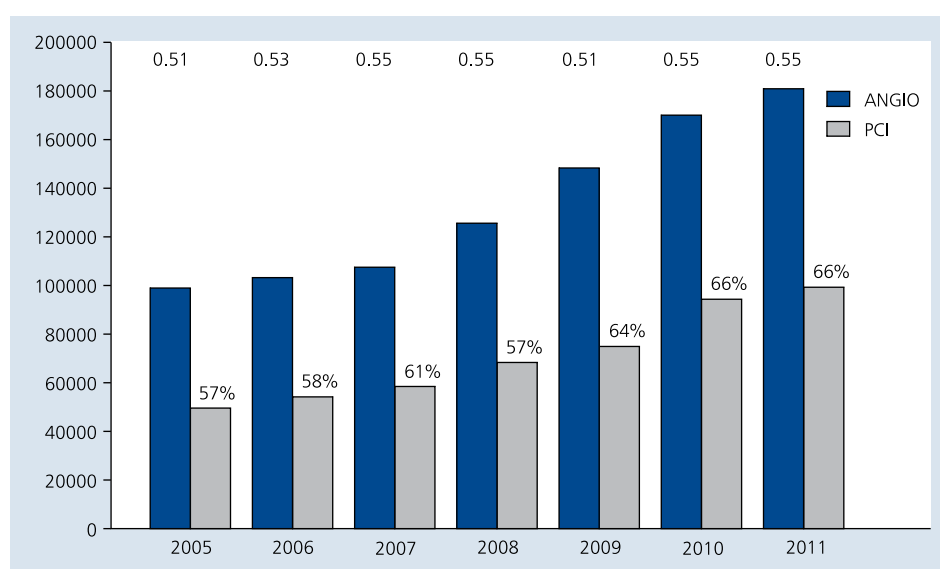


Figure 1. Coronary angiographies (ANGIO) and percutaneous coronary intervention (PCI) procedures with PCI to ANGIO ratio and percentage of PCI in acute coronary syndrome in 2005–2011

Table 1. Baseline demographics and angiography results (ANGIO group)

	2005	2006	2007	2008	2009	2010	2011	P
	N = 99195	N = 103455	N = 107732	N = 125684	N = 148574	N = 169854	N = 180935	
Age [median and IQR]	62.0 [54.0; 70.0]	62.0 [55.0; 71.0]	63.0 [55.0; 71.0]	63.0 [56.0; 72.0]	64.0 [57.0; 73.0]	64.0 [57.0; 73.0]	65.0 [58.0; 74.0]	< 0.001
Gender (males)	65050 (65.6%)	67259 (65.0%)	69378 (64.4%)	79511 (63.3%)	93266 (62.8%)	106736 (62.8%)	112189 (62.0%)	< 0.001
Previous PCI	14153 (14.3%)	16951 (16.6%)	19333 (18.2%)	24853 (19.8%)	31329 (21.1%)	38461 (22.6%)	42725 (23.6%)	0.001
Previous CABG	4210 (4.27%)	4432 (4.34%)	4813 (4.53%)	6216 (4.95%)	7750 (5.22%)	9263 (5.45%)	10078 (5.57%)	< 0.001
Indications:								< 0.001
STEMI					23263 (17.0%)	28177 (16.7%)	28569 (15.8%)	
NSTEMI					18333 (13.4%)	24345 (14.4%)	26831 (14.8%)	
Unstable angina					25603 (18.7%)	37151 (22.0%)	40408 (22.3%)	
Stable angina					63848 (46.7%)	72593 (42.9%)	77356 (42.7%)	
Valvular disease					4857 (3.55%)	5632 (3.33%)	6205 (3.43%)	
Transplantation	191 (0.19%)	178 (0.17%)	142 (0.13%)	177 (0.14%)	192 (0.14%)	190 (0.11%)	253 (0.14%)	
Pacemaker	234 (0.24%)	233 (0.23%)	287 (0.27%)	449 (0.36%)	868 (0.63%)	1132 (0.67%)	1313 (0.73%)	0.001
Access site:								
Radial					32680 (23.9%)	49158 (29.0%)	65196 (36.0%)	
Femoral					103330 (75.4%)	119008 (70.3%)	114679 (63.4%)	
Brachial					785 (0.57%)	886 (0.52%)	994 (0.55%)	
Other					169 (0.12%)	168 (0.10%)	66 (0.04%)	
Angiography:								
One-vessel	23864(24.5%)	26040 (25.6%)	27744 (26.1%)	31130 (25.1%)	40357 (28.0%)	47630 (28.1%)	50012 (27.6%)	0.001
Left main	118 (0.58%)	1698 (2.12%)	1978 (2.20%)	2747 (2.44%)	4931 (3.37%)	6107 (3.60%)	6181 (3.47%)	< 0.001
No changes	28864 (29.7%)	29624 (29.1%)	31384 (29.6%)	38773 (31.3%)	39690 (27.5%)	50161 (29.6%)	55113 (30.5%)	< 0.001
Bridge	1759 (1.78%)	1663 (1.63%)	1341 (1.26%)	1489 (1.18%)	—	—	—	0.001
Decision:								< 0.001
PCI	46514 (47.0%)	50288 (49.3%)	54309 (50.7%)	63297 (50.4%)	68536 (50.0%)	84223 (49.8%)	87813 (48.5%)	
CABG	15715 (15.8%)	14493 (14.2%)	14192 (13.3%)	15008 (11.9%)	15074 (11.0%)	18332 (10.8%)	20082 (11.1%)	
Conservative	36966 (37.2%)	37761 (36.5%)	38783 (36%)	47383 (37.7%)	53354 (39.0%)	66665 (39.4%)	73040 (40.4%)	

CABG — coronary artery bypass graft; IQR — inter-quartile range; NSTEMI — non-ST elevation myocardial infarction; PCI — percutaneous coronary intervention; STEMI — ST-elevation myocardial infarction

Table 2. Baseline demographics and percutaneous coronary intervention results

	2005 N = 50297	2006 N = 54529	2007 N = 58996	2008 N = 68639	2009 N = 75323	2010 N = 94719	2011 N = 99614	P
Age [median and IQR]	63.0 [54.0; 71.0]	63.0 [55.0; 72.0]	63.0 [55.0; 72.0]	64.0 [56.0; 73.0]	64.0 [57.0; 73.0]	65.0 [57.0; 74.0]	65.0 [58.0; 74.0]	0.001
Gender (males)	35073 (69.7%)	37749 (69.2%)	40495 (68.6%)	46581 (67.9%)	50995 (67.7%)	63985 (67.6%)	66577 (66.8%)	< 0.001
Previous MI	19614 (39.0%)	21939 (40.2%)	22898 (38.8%)	27035 (39.4%)	28400 (37.7%)	36218 (38.2%)	37925 (38.1%)	0.001
Hypertension	31733 (63.1%)	35771 (65.6%)	39276 (66.6%)	46669 (68.0%)	54080 (71.8%)	69878 (73.8%)	73435 (73.7%)	0.001
Dyslipidaemia	25007 (49.7%)	25989 (47.7%)	25666 (43.5%)	31573 (46.0%)	36358 (48.3%)	44862 (47.4%)	45241 (45.4%)	< 0.001
Diabetes	7979 (15.9%)	8589 (15.8%)	9929 (16.8%)	12987 (18.9%)	15984 (21.2%)	20909 (22.1%)	22695 (22.8%)	0.001
CKD	1197 (2.38%)	1328 (2.44%)	1787 (3.03%)	2379 (3.47%)	3453 (4.58%)	4727 (4.99%)	4861 (4.88%)	< 0.001
Prior stroke					1889 (2.51%)	2901 (3.06%)	3111 (3.12%)	< 0.001
PAOD					3801 (5.05%)	4911 (5.18%)	5193 (5.21%)	0.262
Previous PCI					21769 (28.9%)	30433 (32.1%)	33837 (34.0%)	< 0.001
Previous CABG					3860 (5.12%)	5181 (5.47%)	5823 (5.85%)	< 0.001
Indications:								< 0.001
STEMI	17856 (35.5%)	19624 (35.9%)	20889 (35.4%)	20932 (30.5%)	20998 (27.9%)	25634 (27.1%)	25654 (25.8%)	
NSTEMI	10729 (21.3%)	12725 (23.3%)	14758 (25.1%)	18423 (26.8%)	12823 (17.0%)	17189 (18.1%)	18431 (18.5%)	
Unstable angina					14614 (19.4%)	19570 (20.7%)	21519 (21.6%)	
Stable angina					26888 (35.7%)	32326 (34.1%)	34010 (34.1%)	
Cardiogenic shock	1396 (2.78%)	1375 (2.52%)	1400 (2.37%)	1515 (2.21%)	1303 (1.73%)	1639 (1.73%)	1609 (1.62%)	< 0.001
Access site:								0.001
Radial					16101 (21.4%)	24581 (26.0%)	31706 (31.8%)	
Femoral					58738 (78.0%)	69581 (73.5%)	67350 (67.6%)	
Brachial					451 (0.60%)	492 (0.52%)	538 (0.54%)	
Other					33 (0.04%)	65 (0.07%)	20 (0.02%)	
Thrombectomy					3111 (4.13%)	4945 (5.22%)	6079 (6.10%)	< 0.001
In STEMI					2593 (12.3%)	4089 (16.0%)	5025 (19.6%)	< 0.001
DES	3031 (6%)	4756 (8.7%)	5654 (9.6%)	11479 (16.7%)	16189 (21.5%)	27266 (28.8%)	38082 (38.2%)	< 0.001
Anticoagulation:								< 0.001
UFH					68233 (90.6%)	88822 (93.8%)	92597 (93.0%)	
LMWH					5047 (6.70%)	5238 (5.53%)	6124 (6.15%)	
Fondaparinux					16 (0.02%)	17 (0.02%)	7 (0.01%)	
Bivalirudin					444 (0.59%)	23 (0.02%)	76 (0.08%)	

Table 2. (cont.) Baseline demographics and percutaneous coronary intervention results

	2005 N = 50297	2006 N = 54529	2007 N = 58996	2008 N = 68639	2009 N = 75323	2010 N = 94719	2011 N = 99614	P
GP IIb/IIIa:								< 0.001
ReoPro	4324 (8.60%)	4438 (8.14%)	4662 (7.90%)	4829 (7.04%)	6851 (9.10%)	7008 (7.40%)	5964 (5.99%)	
Aggrastat	213 (0.42%)	52 (0.10%)	25 (0.04%)	8 (0.01%)	13 (0.02%)	34 (0.04%)	22 (0.02%)	
Integrillin	170 (0.34%)	337 (0.62%)	670 (1.14%)	1182 (1.72%)	4350 (5.78%)	7367 (7.78%)	8870 (8.90%)	
None	45590 (90.6%)	49702 (91.1%)	53639 (90.9%)	62620 (91.2%)	64109 (85.1%)	80310 (84.8%)	84758 (85.1%)	
CTO					1295 (5.89%)	1437 (5.57%)	1581 (5.81%)	0.289
Successful					871 (67.3%)	999 (69.5%)	1019 (64.5%)	0.012

CABG — coronary artery bypass graft; CKD — chronic kidney disease; CTO — chronic total occlusion; DES — drug eluting stent; GP — glycoprotein; IQR — inter-quartile range; LMWH — low molecular weight heparin; MI — myocardial infarction; NSTEMI — non-ST elevation myocardial infarction; PAOD — peripheral arterial occlusive disease; PCI — percutaneous coronary intervention; STEMI — ST-elevation myocardial infarction; UFH — unfractionated heparin

RESULTS

There were 935,429 patients who underwent diagnostic coronary angiography (ANGIO group) and 501,117 who underwent PCI (PCI group) procedure in Poland in 2004–2011 (Fig. 1). Numbers split by years are presented in Tables 1 and 2 and graphically in Figure 1. The PCI to ANGIO ratio as well as percentage of PCI in acute coronary syndrome (ACS) cases is also presented in Figure 1. Baseline demographics for ANGIO and PCI groups stratified by year are presented in Tables 1 and 2. Periprocedural outcome for ANGIO and PCI groups is depicted in Tables 3 and 4. Drug eluting stent (DES) utilisation and radial access site usage among ST elevation myocardial infarction (STEMI), non-STEMI (NSTEMI), unstable angina, and stable angina patients is presented in Figures 2 and 3.

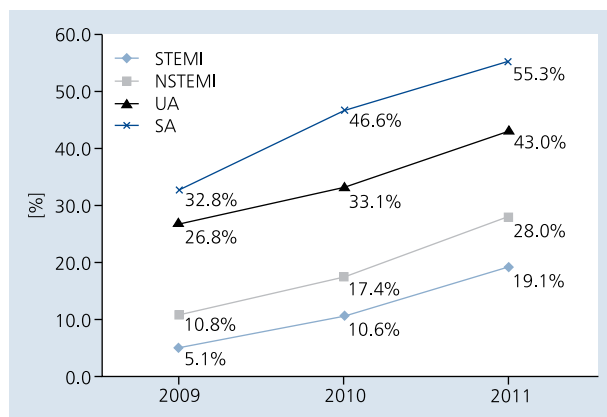


Figure 2. Drug-eluting stent usage in ST-elevation myocardial infarction (STEMI), non-STEMI (NSTEMI), unstable angina (UA), and stable angina (SA) groups, respectively, in 2009–2011 (p < 0.001 for all comparisons)

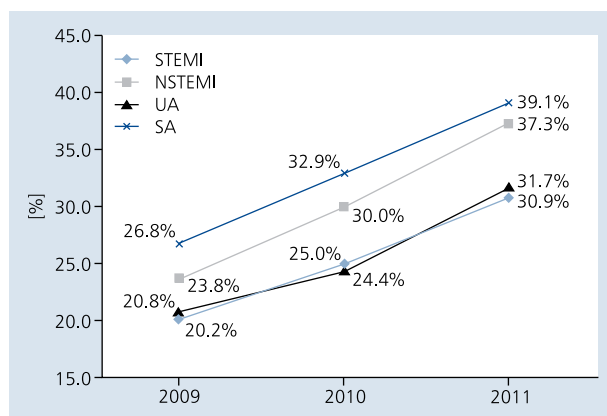


Figure 3. Radial approach in ST-elevation myocardial infarction (STEMI), non-STEMI (NSTEMI), unstable angina (UA), and stable angina (SA) groups, respectively, in 2009–2011 (p < 0.001 for all comparisons)

Table 3. Periprocedural complications of coronary angiography

	2005 N = 99195	2006 N = 103455	2007 N = 107732	2008 N = 125684	P
Death	71 (0.07%)	73 (0.07%)	83 (0.08%)	99 (0.08%)	0.887
MI/reMI	83 (0.08%)	108 (0.1%)	61 (0.06%)	57 (0.05%)	< 0.001
Stroke	–	19 (0.02%)	19 (0.02%)	16 (0.01%)	0.501

MI — myocardial infarction; reMI — repeated myocardial infarction

Table 4. Periprocedural complications of percutaneous coronary intervention

	2005 N = 50297	2006 N = 54529	2007 N = 58996	2008 N = 68639	2009 N = 75323	2010 N = 94719	2011 N = 99614	P
Death	220 (0.44%)	304 (0.56%)	238 (0.40%)	299 (0.44%)	789 (1.05%)	786 (0.83%)	785 (0.79%)	< 0.001
MI/reMI	197 (0.39%)	282 (0.52%)	203 (0.35%)	267 (0.39%)	645 (0.98%)	723 (0.83%)	562 (0.60%)	< 0.001
Stroke					29 (0.04%)	31 (0.03%)	30 (0.03%)	0.287
Urgent CABG	26 (0.05%)	15 (0.03%)	12 (0.02%)	19 (0.03%)	63 (0.08%)	50 (0.05%)	58 (0.06%)	0.001

CABG — coronary artery bypass graft; MI — myocardial infarction; reMI — repeated myocardial infarction

DISCUSSION

The current paper summarises temporal trends and patterns in the invasive treatment of coronary artery disease in Poland based on the National PCI Registry. Since 2005 there has been a year-by-year straight significant trend towards higher numbers of PCI and angiography procedures being performed in Poland. Detailed reporting of invasive procedures in all active invasive cardiology centres and managed at a national level by Polish Cardiac Society allowed to gather data on almost 1.5 million catheterisations and PCIs over a period of seven calendar years (2005–2011). At the same time, the number of catheterisation labs, which are scattered and equally distributed around the country, increased almost by 100% [6, 13]. In 2012, according to the annual report, there was one cathlab per 256,000 inhabitants, which is still well in line with ESC STEMI guidelines [12, 14]. It is noticeable in the Polish registry that the population treated with interventional procedures is becoming older, and the proportion of women has also increased over the years. At the same time, the number of comorbidities that mostly influence coronary artery disease, like diabetes and chronic kidney disease, has risen since 2005. In other words, patient with higher risk are being approached, which surprisingly does not translate into poorer outcome of coronary angiography itself. It is interesting to see that the number of coronary angiographies that report no significant atherosclerotic changes that would require revascularisation of any sort is stable over the years and was reported in 1/3 of patients. That allowed us to admit that the selection and qualification of patients for invasive diagnostics are still appropriate, and the increasing number of cathlabs and procedures is not associated with poorer quality of these

procedures. This is basically confirmed when looking at the numbers describing periprocedural outcome, which has remained the same in terms of death, urgent coronary artery bypass grafting, myocardial infarction, and stroke throughout the years and is fairly low in comparison to other registries.

The situation for the PCI subgroup in terms of survival is slightly different. A significant trend in mortality (from 0.44% in 2005 to 0.79% in 2011) has been noticed. However, one has to take into account the changing demographics. In 2011 vs. 2005 patients referred for PCI were ca. two years older and more frequently with hypertension, diabetes, prior stroke, and chronic kidney disease, which may have triggered higher mortality rates. Even though the number of cases of STEMI treated with PCI has risen in terms of absolute numbers from 2005 to 2011, the overall percentage has decreased mainly in favour of unstable angina, which was more frequently diagnosed. This is similar to German data, in which NSTEMI patients were markedly increased in numbers from 2005 to 2009 [15]. Moreover, as many as 2/3 of all PCIs were performed in 2011 in patients with an ACS, which is a significant increase from 57% in 2005. The use of DES is more frequent in patients with stable angina; however, a trend from 6% in 2005 to 38.2% in 2011 has been observed in the overall PCI population (over 55% in stable angina patients). The utilisation of glycoprotein IIb/IIIa inhibitors is small and a diversion from abciximab to integrillin has been observed. Polish operators are also in line with recent trials and have adopted the radial approach as a preferred one not only in elective cases (over 39% in 2011) but also in a STEMI setting (a 10% absolute increase in two years). Thrombectomy was used in 1 in 5 STEMI patients in 2011.

It seems that a well planned development of interventional cardiology at a scientific and governmental level in Poland has resulted in fulfilling major ESC guideline requirements and the “Stent for Life” initiative aims in a relatively short time [5].

Limitations of the study

The data in the registry including major adverse cardiovascular events were not validated and checked against source documentation. We were also unable to provide follow-up information and long-term outcome of patients.

CONCLUSIONS

The progress of Polish interventional cardiology from 2005 till 2011 is significant in terms of absolute number of angiography and PCI procedures as well as the number of active cathlab centres. Use of modern attributes of interventional cardiology like DES stents, radial approach, and treatment of higher risk patients has been increasing over the years. The numbers of periprocedural life-threatening complications are low and stable in occurrence in patients undergoing coronary angiography. The adoption of the “Stent for Life” initiative has resulted in an increasing number of percutaneous coronary procedures over the years.

Conflict of interest: Maciej Lesiak — lectures and consultant for AstraZeneca, Abbott Vascular, Boston Scientific, Biotronic, TRYTON Medical.

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Zmiany w leczeniu inwazyjnym choroby niedokrwiennej serca w Polsce w latach 2005–2011

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Streszczenie

Wstęp: Polska jest jednym z liderów kardiologii interwencyjnej w Europie w odniesieniu do liczby przezskórnych interwencji wieńcowych (PCI) na 1 milion mieszkańców wykonywanych w ostrym zawałe serca.

Cel: Celem pracy było zaprezentowanie zmian w epidemiologii, charakterystyce demograficznej, leczeniu i wynikach terapii pacjentów, u których wykonywano koronarografię i zabiegi angioplastyki wieńcowej w Polsce w latach 2005–2011 na podstawie Ogólnopolskiego Rejestru Procedur Kardiologii Inwazyjnej (ORPKI).

Metody: Przeanalizowano dane kolejnych pacjentów poddanych angiografii wieńcowej (grupa ANGIO) oraz zabiegowi przezskórnej angioplastyki wieńcowej (grupa PCI), których włączono do prospektywnego rejestru ORPKI w Polsce.

Wyniki: W latach 2005–2011 w grupie ANGIO zebrano dane o 935 429 pacjentach, natomiast w grupie PCI o 501 117 chorych. Liczba pracowni kardiologii inwazyjnej wzrosła z 75 do 137, a liczba angiografii wieńcowych wykonywanych rocznie z 99 195 do 180 935, natomiast liczba PCI odpowiednio z 50 297 do 99 614. Wewnątrzszpitalna śmiertelność okołozabiegowa i częstość udarów mózgu były podobne w ciągu lat u pacjentów, u których wykonywano koronarografię, natomiast zwiększyła się śmiertelność okołozabiegowa w grupie osób, u których przeprowadzono PCI. Użycie stentów uwalniających leki (DES) u chorych ze stabilną dławicą piersiową wzrosło z 32,8% do 55,3%, a stosowanie dostępu promieniowego z 26,8% do 39,1%.

Wnioski: Stosowanie stentów typu DES, dostępu promieniowego i wykonywanie zabiegów inwazyjnych u chorych coraz większego ryzyka uległo istotnemu zwiększeniu w Polsce w latach 2005–2011. Zastosowanie się do idei programu "Stent for Life" zaowocowało zwiększającą się co roku liczbą procedur kardiologii inwazyjnej.

Słowa kluczowe: angiografia, angioplastyka, choroba niedokrwienna serca, epidemiologia

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