RESEARCH LETTER

Revascularization in patients with ST-segment elevation myocardial infarction and multivessel coronary artery disease: preliminary results from a large multicenter national registry

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Introduction The management of the acute phase in patients with ST-segment elevation myocardial infarction (STEMI) has evolved substantially over the past decade due to significant improvements in the STEMI networks, intracoronary tools and devices, and the advent of potent antiplatelet agents. Data from previous studies indicate that patients with multivessel coronary artery disease (MVD) and no hemodynamic compromise have an adverse prognosis following primary percutaneous coronary intervention (pPCI) irrespective of an excellent acute result in the infarct-related artery (IRA).[1] The general concept of staged or immediate PCI for complete revascularization in patients with STEMI has been previously proven to be beneficial in terms of co-primary outcomes, and supported by a limited number of studies.[2-6] Of them, only the COMPLETE (Complete revascularization with multivessel PCI for myocardial infarction) trial[2] was adequately powered for the composite end point of cardiovascular death or myocardial infarction, as well as that outcome plus ischemia-driven revascularization. Thus, according to the current guidelines, routine revascularization of non–infarct-related lesions should be considered before hospital discharge.[7] However, the techniques for nonculprit lesion detection, suitability of single- vs multistage strategy, and optimal timing of nonculprit vessel revascularization remain to be determined. In addition, the number of patients with a significant lesion in the non-IRA territory has not been evaluated during the last decade in Poland. The aim of the present study was to review the real-life epidemiology and clinical characteristics of Polish patients with STEMI and MVD.

Patients and methods The Polish Registry of Acute Coronary Syndromes (PL-ACS) was launched in 2003. The principles of our registry have been published elsewhere.[8] Briefly, this is a national, multicenter, ongoing, prospective observational registry that includes data on patients with acute coronary syndrome treated in Poland. By the end of 2019, we were able to collect data on 775 278 patients. Since 2017, the collection of data related to coronary anatomy has become available for 126 998 cases. There were 35 874 patients with STEMI (28.2%). Of them, 29 384 (81.9%) underwent pPCI within the first 12 hours of the symptom onset. After exclusion of 1050 patients with cardiogenic shock (3.6%), 3035 individuals (10.3%) with prior or planned coronary artery bypass grafting, and 1395 cases (4.7%) of myocardial infarction with nonobstructive coronary arteries, we analyzed a group of 23 904 patients. Data on lesion significance (ie, percent stenosis in the visual assessment) were available in 15 231 cases (63.7%). We excluded 10 224 patients with culprit lesions present solely in 1 of the 4 coronary arteries (ie, left main [LM], left anterior descending [LAD], circumflex [Cx], and right coronary artery) together with their branches (ie, intermediate, diagonal [D], obtuse marginal

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TABLE 1 Baseline characteristics, medication, coronary angiography results, and revascularization strategy in patients with multivessel coronary artery disease

Variable	3-vessel disease (n = 1352)	2-vessel disease (n = 3655)	*P* value
Medical history			
Arterial hypertension	879 (67.6)	2258 (64.3)	0.04
Dyslipidemia	557 (44.7)	1332 (40)	0.004
Diabetes	379 (28.9)	871 (24.7)	0.003
Smoking	740 (54.7)	2204 (60.3)	<0.001
Obesity	286 (22.3)	838 (24.3)	0.15
Myocardial infarction	175 (13)	498 (13.7)	0.54
Heart failure	76 (5.7)	187 (5.2)	0.48
Atrial fibrillation	105 (7.8)	205 (5.7)	0.007
Stroke	80 (5.9)	151 (4.2)	0.01
Peripheral artery disease	60 (4.5)	116 (3.2)	0.04
Chronic kidney disease	91 (6.8)	150 (4.1)	<0.001
COPD	46 (3.4)	119 (3.3)	0.86
On-site medication			
Acetylsalicylic acid	1277 (94.5)	3409 (93.3)	0.13
Ticagrelor	550 (40.7)	1599 (43.7)	0.05
Clopidogrel	676 (50)	1688 (46.2)	0.02
Unfractionated heparin	1314 (97.2)	3570 (97.7)	0.35
LMWH	207 (15.3)	481 (13.2)	0.05
GP IIb/IIIa inhibitor	375 (27.7)	1058 (28.9)	0.42
Culprit artery			
RCA	600 (44.4)	1637 (44.8)	0.79
LM	31 (2.3)	34 (0.9)	<0.001
LAD	503 (37.2)	1352 (37)	0.89
Cx	153 (11.3)	433 (11.8)	0.62
Other (OM, D, IM)	81 (6)	248 (6.8)	0.33
Nonculprit artery			
RCA	706 (52.2)	1033 (28.3)	<0.001
LM	85 (6.3)	44 (1.2)	<0.001
LAD	718 (53.1)	1122 (30.7)	<0.001
Cx	842 (62.3)	912 (25)	<0.001
Other (OM, D, IM)	559 (41.3)	684 (18.7)	<0.001
Nonculprit artery PCI			
Immediate	273 (20.2)	539 (14.7)	<0.001
Staged	637 (47.1)	1564 (42.8)	0.006
Readmission	528 (39.1)	868 (23.7)	<0.001
Not planned	418 (30.9)	1223 (33.5)	0.09

Data are presented as number (percentage) of patients.

Abbreviations: COPD, chronic obstructive pulmonary disease; Cx, circumflex branch of left coronary artery; D, diagonal branch of left coronary artery; GP, glycoprotein; IM, intermediate branch of left coronary artery; LAD, left anterior descending artery; LM, left main artery; LMWH, low-molecular-weight heparin; OM, obtuse marginal branch of left coronary artery; PCI, percutaneous coronary intervention; RCA, right coronary artery

[OM], and posterior descending artery, respectively), including the patients with culprit and nonculprit lesions located in the main and side branches or 2 side branches of the same main branch (eg, LAD and D, n = 134; Cx and OM1 or OM2, n = 55; D1 and D2, n = 0; OM1 and OM2, n = 6), as they were considered cases of single vessel disease. The final study group involved 5007 patients (32.9%). They were classified as 2- or 3-vessel disease (VD) cases if the significant nonculprit lesion was located in at least 1 coronary branch remote from the IRA. The significance of the nonculprit lesion was defined as either more than 70% stenosis in visual assessment irrespective of whether the PCI was performed or not, or more than 50% stenosis and confirmed data on the PCI in that lesion. Information on baseline clinical characteristics, medication, coronary intervention, and in-hospital follow-up was collected. The study was approved by the local Ethics Committee (6/2017).

Statistical analysis Categorical variables were presented as numbers and percentages. Comparisons between groups were conducted using the χ^2 test. The only continuous variable was age. Due to its non-normal distribution, it was presented as median and interquartile range (IQR). The normality assumption was verified with the Kolmogorov–Smirnov test. The analyzed groups were compared by the Wilcoxon–Mann–Whitney test. A *P* value below 0.05 was considered significant. Statistical analysis was performed using SAS software, version 9.4 (SAS Institute Inc., Cary, North Carolina, United States).

Results and discussion A total of 5007 patients (women, 30.1%) were included. Patients with 3-VD were older (median [IQR], 67.5 [60.7–75.2] vs 65.2 [58.8–72.7] years; *P* <0.001), more often had a Killip class greater than 1 on admission (21.4% vs 18.6%; *P* = 0.01), and more frequently had arterial hypertension, dyslipidemia, diabetes, atrial fibrillation, chronic kidney disease, peripheral artery disease, and previous stroke than individuals with 2-VD. The rate of previous PCI was similar in both groups (10.6% vs 12.3; *P* = 0.11). Prehospital cardiac arrest was rare (4% vs 3.2%; *P* = 0.19). Radial access was chosen most frequently in both groups (78.9% vs 81.8%; *P* = 0.06). The in-stent restenosis (2.1% vs 2%; *P* = 0.74), in-stent thrombosis (1.1% vs 1.1%; *P* = 0.88), and bifurcation lesion rates (3% vs 3.4%; *P* = 0.47) were low. Left main coronary artery was more frequently infarct-related in the 3-VD group. Patients with 3-VD more often underwent PCI of the nonculprit vessel. The rate of dual antiplatelet therapy was lower in the 3-VD group (90% vs 92.5%; *P* = 0.006). In-hospital complication rates were low and included reinfarction (0.1% vs 0.2%; *P* >0.99), target vessel revascularization (0.7% vs 0.5%; *P* = 0.41), stroke (0.4% vs 0.3%; *P* = 0.79), mechanical complications (0.7% vs 0.5%; *P* = 0.41), and bleeding (1% vs 0.9%; *P* = 0.87). The rate of complete revascularization during the initial hospitalization was lower in the 3-VD group than in the patients with 2-VD (7.1% vs 42.8%; *P* <0.001), whereas in-hospital cardiovascular mortality was greater in individuals with 3-VD (5.2% vs 2.8%; *P* <0.001). All other results are summarized in TABLE 1.

An additional significant lesion in the non-IRA territory may be present in up to half of STEMI patients undergoing pPCI.[1] Although several studies on the negative impact of MVD in Polish patients with STEMI were published,[9,10] we are the first to demonstrate the current real-life epidemiology and in-hospital follow-up in this group. In comparison with previously published data,[2-6,11] we analyzed the greatest number of patients, including the greatest female sex ratio. Data on the LM involvement were not available in the majority of publications, except for the COMPLETE[2] and Compare-Acute[6] trials, which reported the rates of significant LM lesions of 0.2% and 0.3%, respectively. In our population, that rate was up to 10 times higher in the culprit, and even greater in the nonculprit LM location. As the lesion selection criteria differ between trials and currently there is no consensus on this matter, we arbitrarily defined the lesion significance in concordance with the approach used previously.[12] The exclusion of patients with the nonculprit lesion within the IRA branch was due to their concurrent and overlapping supply area. Fortunately, the exclusion rate for that reason was low (1.3%). Furthermore, we identified 19.4% of patients presenting with a Killip class greater than 1. These rates were lower in the previous studies, and in the PRAMI trial (Randomized trial of preventive angioplasty in myocardial infarction),[4] this information was not reported at all. In addition, we presented data on previous medical history (ie, obesity, heart failure, peripheral artery disease, chronic obstructive pulmonary disease), while such information was not available in the previous trials. We believe the deleterious impact of these comorbidities on mortality should not be neglected in multivariable predicting models. Interestingly, the Polish patients less frequently received aspirin or a P2Y12 inhibitor than individuals from other countries. In the available trials,[2-6] the dual antiplatelet therapy (DAPT) rates varied between 96% and 100%, while we noted the rates of 93.6% for aspirin and 90.1% for a P2Y12 inhibitor. There is no reasonable explanation for this finding at the moment. To better understand the Polish reality, several facts should be considered: (1) cangrelor is unavailable in Poland, (2) in our study the prasugrel administration rates were very low (0.6% vs 0.9%; $P = 0.37$; data not shown), (3) fibrinolysis has been eliminated almost entirely by the excellent STEMI networks (with <0.5% utilization rate), and consequently, (4) the rescue PCIs are extremely rare. In the context of atrial fibrillation, triple therapy (ie, DAPT + oral anticoagulant) poses a great risk of bleeding complications. In our study, the DAPT rates did not depend on the specific agents. We hypothesize that the relatively high number of previous strokes and episodes of atrial fibrillation might partially explain the decrease in the total number of patients treated with DAPT, as they might have received an oral anticoagulant and clopidogrel without aspirin. Following the preliminary data, we plan to provide the most comprehensive analysis of Polish patients with STEMI and MVD to identify the patient risk profile, optimal timing of revascularization, and possible methods for the reduction of cardiovascular mortality and secondary end points. We believe that the results will add to the current knowledge and will help manage patients with STEMI.

Our report has several limitations. First, although the sample size was large, it represents less than 50% of all STEMI cases in Poland (35 874 in our analysis vs 81 700 reported by the National Health Fund, data not shown). In addition, our complex exclusion criteria further limited the total number of patients included. Second, the center representation was asymmetric across the country. Unfortunately, this is a common flaw of all registries and it cannot be attributed to PL-ACS only. Both limitations are in line with those reported in other studies.[13] Third, regardless of the initial formal training, the irregularity in data audition and validation may bias the data entry (ie, incomplete or missing data).

ARTICLE INFORMATION

NOTE The registry URL: https://pl-acs.sccs.pl/

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