

Safety and feasibility of single-day coronary angioplasty in low- and moderate-risk patients: candidate selection criteria, management protocol, and outcomes

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Introduction Coronary heart disease (CHD) is one of the leading causes of death worldwide, and percutaneous coronary intervention (PCI) is the most common method of invasive treatment of CHD.^{1,2} Therefore, the implementation of a novel approach to PCI—a single-day or ambulatory procedure (SD PCI)—is a major step towards the introduction of modern cardiological care, flexibility, and novelty into the health care system. The development and spread of SD PCI resulted from the generalization of the radial approach and progress in the field of angioplasty materials and stent technology. The safety and feasibility of SD PCI have been proved in many trials, and in several countries the majority of PCI procedures are performed as SD PCIs.²⁻⁴ However, the criteria for SD PCI patient selection are not clearly established: they vary between centers, and patients at higher risk of complications are underrepresented in published studies.²⁻⁴

The aim of this study was to evaluate the patient selection criteria, in-hospital management protocol, and outcomes of 1-month follow-up after the procedure performed at the Department of Cardiology and Invasive Angiology, National Institute of Cardiology in Warsaw, Poland. We focused on patient safety, improvement of clinical symptoms, and patient satisfaction.

Patients and methods Our SD PCI program included patients of all ages, with multivessel disease, who had undergone multivessel angioplasty (including left main stem angioplasty), and in whom the radial approach was possible. Exclusion criteria comprised left ventricular ejection fraction lower than 35%, estimated glomerular filtration rate (eGFR) lower than 40 ml/min/1.73 m², chronic total occlusion, and previous coronary

bypass angioplasty. Individuals who lived far from the site (duration of transport >60 min) and had no one to accompany them were also excluded. Selection of patients eligible for SD PCI was performed in several steps. First, we analyzed the referral documents and attached files. Next, each hospitalization and procedure were preceded by 2 telephone interviews, the first conducted by a medical secretary (2–3 weeks before admission) and the second by a performing physician (2–3 days before the procedure), to discuss the current clinical status, medication treatment (especially antiplatelet, antithrombotic, and diuretic), and comorbidities. The patients were also informed about the nature and protocol of the program called “Single-day coronary angiography/PCI hospitalization” and asked to report to the hospital with the results of their latest blood tests, blood typing, and other relevant medical files (echocardiography, 24-hour ambulatory electrocardiography monitoring [if applicable], and details regarding comorbidities). On admission (6:30 am), all patients had routine angiography-related blood tests performed (complete blood count, creatinine, eGFR, electrolytes, lipid profile, thyroid stimulating hormone, and—if necessary—blood typing).

All SD PCIs were performed using the radial approach. After the procedure, the patients rested in an armchair, received 1000 to 1500 ml of fluid infusion, and were supervised by experienced personnel and a heart monitor. The early discharge decision was made 4 to 6 hours following an uncomplicated procedure, by both the patient and the physician. The patients had to be in a stable clinical condition, without chest discomfort or ischemic changes on electrocardiography, and with radial compression removed.

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TABLE 1 Single-day coronary angioplasty: patient and procedure characteristics, and results of the 30-day follow-up

Parameter	Value
Patient characteristics (n = 250)	
Age, y, mean (SD; range)	66.3 (9.7; 35–88)
Male sex, n (%)	177 (70.8)
LVEF, %, mean (SD; range)	57.5 (6.4; 35–70)
eGFR, ml/min/1.73 m ² , mean (SD)	63.8 (11.8)
Diabetes, n (%)	83 (33.0)
Previous MI, n (%)	66 (26.3)
Multivessel disease, n (%)	136 (54.7)
Procedure characteristics	
Ad hoc PCI, n (%)	177 (62.7)
Number of stents, mean (SD)	1.3 (0.6)
Total stent length, mm, median (IQR)	20 (15–30)
Complex PCI ^a , n (%)	90 (39.1)
Left main stem angioplasty, n (%)	2 (0.8)
Follow-up outcomes, n (%)	
Death	0
Acute coronary syndrome without reintervention	1 (0.4)
Cardiological rehospitalization	2 (0.8)
Nonscheduled cardiological outpatient consultation	2 (0.8)
Access site pain or hematoma	9 (3.6)
Neurological hospitalization	2 (0.8)
Patients' evaluation and opinion, n (%)	
Significant clinical improvement after SD PCI	209 (83.9)
SD PCI considered safe	240 (97.9)
SD PCI considered more comfortable than overnight stay	243 (97.0)

a Bifurcations, multivessel PCI, or 3-vessel disease

Abbreviations: eGFR, estimated glomerular filtration rate; IQR, interquartile range; LVEF, left ventricular ejection fraction; MI, myocardial infarction; SD PCI, single-day percutaneous coronary intervention

At discharge, all the patients were informed about obligatory antiplatelet therapy and the need to keep the hydration level increased during 3 to 4 days after the procedure. Some patients (elderly, with borderline eGFR) were advised to perform control tests of creatinine and eGFR levels within a week of the procedure and report to their family physicians with the results. On day 30 after the procedure, a follow-up telephone interview was carried out by an experienced medical secretary. The study was approved by the Local Ethics Committee (decision no. 1785) and each patient provided written informed consent to participate.

The study group (SD PCI) involved 250 consecutive patients who were admitted and discharged on the same day, a few hours after the PCI procedure. Despite meeting the selection criteria, a total of 53 patients who were originally selected as candidates for SD PCI were finally qualified for a longer hospital stay due to acute complications or other safety reasons. The causes of a longer hospitalization were as follows: an unexpectedly long or complex procedure (n = 29), cardiovascular ischemic complications (n = 14), shift to the femoral approach (n = 5), and neurological

and vaso-vagal reactions (n = 5). We decided not to compare the SD PCI patients with the longer stay group since differences in the procedure characteristics and results seem to be obvious. This is in agreement with many studies suggesting that SD PCI outcomes should not be compared with the results obtained in an overnight group but with PCI outcomes from large multicenter and national registries in which major adverse cardiac events and readmission rates did not exceed 1% and 5%, respectively.³⁻⁵

Results Detailed characteristics of the study patients, angioplasty procedures, and follow-up results are presented in **TABLE 1**. Of note, our group was not limited to low-risk patients, but included individuals at both low and moderate risk of complications. The majority of our patients had multivessel disease, 2 of them underwent left main stem angioplasty, nearly 40% of the procedures were defined as complex according to the listed criteria, and we included patients without the age limit.

During the 30-day follow-up none of the patients died. A single patient had acute coronary syndrome due to occlusion of the small side branch, which was found on angiography 3 days after the SD PCI but did not require reintervention. One other patient was hospitalized due to chest discomfort without increase in troponin levels and was discharged without coronary angiography. Two patients were admitted with a suspicion of an acute neurological episode and in 1 of them transient ischemic attack was confirmed on magnetic resonance imaging. The total rehospitalization rate was 1.6%, that is, 4 patients. In the opinion of the patients themselves, 83.9% of the procedures resulted in a significant improvement in cardiological symptoms. Importantly, 97% of the patients found SD PCI safe and more comfortable than the traditional approach that requires overnight hospitalization.

Discussion The results of our study, especially the small number of cardiac and noncardiac events during the follow-up, clearly show that coronary angioplasty can be safely performed as a single-day procedure in selected patients from low- and moderate-risk groups. The results confirm that the original patient selection criteria adopted in our center, based on our experience and available literature, were appropriate. With respect to our in-hospital management protocol, 97% of the patients found SD PCI safe and comfortable.

SD PCI is considered cost-efficient, reduces the risk of in-hospital infections, and is preferred by the patients as it enables them to avoid the stress of an overnight stay in the hospital. However, the implementation of SD PCI varies significantly across different centers and countries. In practice, it depends mostly on the local experience and organization. In leading centers with an individual, patient-centered approach,

its prevalence increased to over 80% of all PCI procedures.⁴ The reported cost saving is about USD 5000 or 16% per procedure.^{4,6} Of note, the barriers to the implementation of SD PCI are not evidence-based. It is known that acute complications, if they occur, usually manifest during the first 6 hours after the PCI, and the period between 6 and 24 hours post angioplasty is relatively free from cardiac events.⁷ The barriers are numerous and complex: psychological (on both sides: patients and doctors), organizational, financial (fear of reduced reimbursement), and legal (greater responsibility). Through the results of the present study we would like to encourage specialists in other centers to introduce an SD PCI program in their institutions as it is cost-saving and reduces the risk of in-hospital infections, which is particularly important in the COVID-19 era.^{8,9} SD PCI should be first introduced in low-risk patients who are in good general condition and would like to avoid an overnight stay in the hospital. It is also important to inform the patients that they may contact the hospital staff or come back to the performing center at any time in case of doubt or complications.

Conclusions Single-day coronary angioplasty may be safely performed in selected patients from low- and moderate-risk groups. The patient selection criteria and patient in-hospital management protocol proposed in this study are safe, were accepted by the patients, and resulted in a low number of events during the 30-day follow-up. Single-day coronary angioplasty should be developed and propagated as it is safe, cost-saving, preferred by the majority of patients, and reduces the risk of in-hospital infections.

ARTICLE INFORMATION

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