Original Article

Percutaneous coronary intervention in patients with multivessel disease in Brazil

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ABSTRACT

Introduction: Percutaneous coronary intervention (PCI) in patients with multivessel disease is associated with a lower success rate and a higher incidence of complications. The results of this treatment in Brazil are poorly studied. The objective of this study was to analyze the results of PCI performed in patients with multivessel disease, which were registered in the National Center for Cardiovascular Interventions (CENIC) registry.
Methods: Complete electronic records of procedures performed in patients with multivessel disease from 2006 to 2016 were analyzed.
Results: A total of 191,127 PCI were submitted to the CENIC registry in the study period, including 80,093 (45.3%) cases classified as multivessel disease. The patients were predominantly male (67.5%) with stable (49.6%), two-vessel disease (65%). Type B_2/C lesions were present in 70.8% of the cases, with a mean of 1.6 artery treated per patient and 1.7 stent implanted per procedure, 71.6% of which were bare-metal stents. The success rate was 96%. During hospitalization, the occurrence of major adverse cardiac events was 1.5%, and death was the most frequent complication (1.2%). Independent predictive factors of death were age, sex, diabetes mellitus, previous infarction, the extent of coronary disease, the use of glycoprotein IIb/IIIa inhibitors, acute coronary syndrome, emergency interventions and procedures undertaken in the 2006-2008 period.
Conclusions: Multivessel PCI has a high success and a low in-hospital complication rate. The identification of characteristics associated with a poor prognosis can be useful for stratification and for the selection of the most appropriate treatment strategy.

Intervenção coronária percutânea em pacientes multiarteriais no Brasil

Palavras-chave:
Intervenção coronária percutânea
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RESUMO

Introdução: A intervenção coronária percutânea (ICP) em pacientes multiarteriais está associada a menores taxas de sucesso e à maior incidência de complicações. Os resultados deste tratamento no Brasil são pouco conhecidos. O objetivo deste trabalho foi analisar as ICP realizadas em pacientes multiarteriais reportadas ao registro CENIC.
Métodos: Foram analisadas as fichas eletrônicas completas de procedimentos efetivados em pacientes multiarteriais no período de 2006 a 2016.
Resultados: Foram submetidas ao registro CENIC 191.127 ICP no período estudado, das quais 80.093 (45,3%) classificadas como de múltiplos vasos. Os pacientes eram predominantemente do sexo masculino (67,5%), portadores de doença estável (49,6%) e comprometimento biarterial (65%). Lesões tipo B_2/C corresponderam a 70,8% dos casos, com média de 1,6 vaso tratado por paciente e 1,7 stent implantado por procedimento, sendo 71,6% stents não farmacológicos. A taxa de sucesso foi de 96%. Durante a fase hospitalar, a ocorrência de eventos cardiovasculares adversos maiores foi de 1,5%, sendo o óbito a complicação mais frequente (1,2%). Os fatores preditores independentes de óbito foram idade, sexo, diabetes melito, infarto prévio, extensão da doença coronária, uso de inibidores de glicoproteína IIb/IIIa, síndrome coronariana aguda, intervenções emergenciais e procedimentos efetivados no triênio 2006-2008.
Conclusões: A intervenção coronária percutânea multiarterial possui elevado porcentual de sucesso e pequena taxa de complicações hospitalares. A identificação de características associadas a pior prognóstico pode ser útil na estratificação e na seleção da estratégia de tratamento mais adequada.

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Introduction

Myocardial revascularization is a treatment modality for patients with coronary artery disease that aims to alleviate symptoms and/or improve prognosis. The annual risk of cardiac death or non-fatal acute myocardial infarction (AMI) is 4 to 6% among stable patients with moderate or severe myocardial ischemia.[1] Similarly, patients with acute coronary syndrome ACS, who exhibit high-risk characteristics, have a better prognosis when subjected to an invasive strategy, aiming at a revascularization procedure.[2] When revascularization is indicated, the potential benefits, risks of complications and the patient's preferences must be considered to determine whether to proceed with surgical or percutaneous revascularization. In patients with multivessel coronary disease, this decision is more complex given that results from randomized comparative trials are not generalizable. Furthermore, the safety and efficacy of both of these treatment modalities in Brazil are still poorly studied, and the choice is frequently arbitrary.[3]

To find information for collaborative decision-making, clinical records are very important because their data complement the findings of multicenter randomized trials. Therefore, the results can be assessed for reproducibility on a large scale in other populations and under various circumstances, such as resource availability.[4] In 1991, the Brazilian Society of Hemodynamics and Interventional Cardiology (SBHCI, acronym in Portuguese) implemented the National Center for Cardiovascular Interventions (CENIC, acronym in Portuguese) as a registry of percutaneous coronary interventions (PCIs) performed in Brazil. It was the first national initiative to assess the development and evolution of PCI and has stimulated continuous improvements in the quality of patient care.

The objective of this study was to assess temporal trends in demographic, clinical and anatomical characteristics and in-hospital results of PCI in patients with multivessel disease performed in interventional cardiology centers in Brazil that were reported to the CENIC and to evaluate the associations of clinical and anatomical variables with hospital outcomes.

Methods

The process of data acquisition and storage in the CENIC registry has been described elsewhere.[5] Sending data to CENIC is voluntary and consists of completing standardized digital forms regarding clinical and angiographic aspects of the procedure, immediate results and complications during hospitalization. Data collection was initiated in 1992.

The present study addressed PCI performed in patients with multivessel disease from 2006 to 2016. No reported procedure was excluded. Multivessel coronary disease was considered when a lesion obstructed > 50% of at least two major epicardial coronary arteries or their side branches. Patients who exhibited lesions obstructing > 50% of two or more side branches of the same artery were classified as one-vessel disease. Angiographic variables were analyzed by visual estimation by the operators, and definitions were based on the Guideline for Percutaneous Coronary Intervention and Adjunct Diagnostic Methods in Interventional Cardiology of the SBHCI.[6]

Temporal trends of the studied variables were assessed by dividing the analysis into three periods: 2006-2008, 2009-2011 and 2012-2016. The procedure was considered successful when a residual lesion obstructed < 50% of an artery in non-stent procedures and < 30% in those that endoprostheses were used. Major adverse cardiac events included death, AMI or emergency revascularization.

Statistical analysis was performed with the Statistical Package for the Social Sciences (SPSS), version 19. Continuous variables were compared with the Chi-square test and, when necessary, the likelihood-ratio test. Categorical variables were compared by analysis of variance (ANOVA), with Bonferroni correction in multiple comparisons. The influence of the variables of interest with respect to mortality was assessed with simple logistic regression. In multiple logistic regression models, the forward selection method determined the independent variables. Variables with high rates of missing data (Killip class, left ventricular dysfunction and presence of collateral circulation) were not included in the multivariate analysis. Statistical significance was considered at 5% (p value < 0.05).

Results

In the studied period (2006-2016), CENIC received data for 191,127 PCI performed in 176,780 patients. Of these, 80,093 (45.3%) cases were classified as multivessel disease and a total of 86,153 procedures were performed, constituting the study sample. Six hundred seventeen SBHCI centers submitted forms, corresponding to 55.8% of all centers with registered authorization to perform PCI at the time of the study.

Table 1 shows the patients' clinical characteristics. There was a discrete but significant increase in age over time ($p < 0.0001$), and male sex was predominant. The prevalence of smoking decreased progressively ($p < 0.0001$), and other risk factors, such as arterial hypertension, diabetes mellitus and dyslipidemia, increased ($p < 0.0001$). For past history, approximately 20% of the patients had previous AMI and PCI, with a progressive increase in the latter ($p < 0.001$).

Table 2 shows the angiographic characteristics of the procedures. Regarding the extent of coronary artery disease, patients with two-vessel disease were predominant (65%), and the left anterior descending artery was the most commonly addressed vessel (38.6%). The ratio of type B_2/C lesions increased, reaching almost 90% of the lesions treated in the 2012-2016 period, with a paradoxical decrease in the prevalence of unfavorable anatomical characteristics. The mean number of treated arteries per patient was 1.6, and coronary stents were used in approximately 95% of the cases. The success rate of the interventions was high and increased over time (Table 3).

During hospitalization, the rate of major adverse cardiac events was 1.5%, which decreased after the first triennium, and death was the most frequent complication (Table 4). As shown by simple logistic regression, the likelihood of death increased by 5% per year of age, and it was highest among women (Table 5). Multivessel disease, especially three-vessel disease, acute coronary syndrome and left ventricular dysfunction were significantly related to death. The variables that remained predictive of death after multivariate analysis were age, sex, diabetes mellitus, previous AMI, the extent of coronary artery disease, the use of glycoprotein IIb/IIIa inhibitors, acute coronary syndrome, emergency interventions and procedures performed in the 2006-2008 triennium (Table 6).

Discussion

The present study shows that multivessel PCI is efficient and safe according to the CENIC registry, with success and complication rates similar to those published in international registries.[7-14] The studied sample was mainly composed of men of advanced age with multiple comorbidities. Compared to the demographic profiles of patients in 1996 and 1997, the studied population was older (a mean of 5 years) and had a higher probability of previous PCI.[15] Furthermore, despite the increasing complexity of clinical and angiographic profiles among treated patients, the rate of complications significantly decreased between 2006 and 2016, especially for death and AMI.

Our findings show that the predictive factors for complications following PCI in Brazil are consistent with those reported in the current literature.[16-18] In several national and international registries,

Table 1
Baseline clinical and demographic characteristics

Characteristics	2006-2008 (n = 25,806)	2009-2011 (n = 29,894)	2012-2016 (n = 24,393)	Total (n = 80,093)	*p*-value
Age, years	63.7 ± 11.2	64.1 ± 11.1	64.2 ± 11.1	64 ± 11.2	< 0.0001
Male sex, n (%)	17,421 (67.5)	20,096 (67.2)	16,540 (67.8)	54,057 (67.5)	0.35
Smoking, n (%)	7,135 (27.6)	6,835 (22.9)	5,003 (20.5)	18,973 (23.7)	< 0.0001
Hypertension, n (%)	21,299 (82.5)	24,890 (83.3)	20,539 (84.4)	66,728 (83.4)	< 0.0001
Dyslipidemia, n (%)	16,050 (62.2)	18,123 (61.4)	15,639 (64.6)	49,812 (62.7)	< 0.0001
Diabetes mellitus, n (%)	7,180 (27.8)	7,502 (27.1)	6,166 (29.3)	20,848 (28)	< 0.0001
Previous AMI, n (%)	5,568 (21.6)	5,614 (20.3)	3,877 (18.5)	15,059 (20.2)	< 0.0001
Previous PCI, n (%)	5,344 (21.1)	6,148 (21.2)	5,965 (25)	17,457 (22.3)	< 0.0001
Previous CABG, n (%)	3,491 (13.5)	3,727 (12.5)	2,531 (10.4)	9,749 (12.2)	< 0.0001
Clinical presentation, n (%)					< 0.0001
Stable angina	10,669 (41.3)	12,188 (40.8)	9,263 (38)	32,120 (40.1)	
Silent ischemia	2,103 (8.1)	2,873 (9.6)	2,616 (10.7)	7,592 (9.5)	
STEMI	5,197 (20.1)	5,346 (17.9)	4,392 (18)	14,935 (18.6)	
NSTEMI	7,837 (30.4)	9,480 (31.7)	8,122 (33.3)	25,439 (31.8)	
Killip class, n (%)					< 0.0001
I	3,746 (72.6)	3,957 (74.1)	3,457 (78.7)	11,160 (74.9)	
II	800 (15.5)	800 (15)	523 (11.9)	2,123 (14.3)	
III	274 (5.3)	225 (4.2)	169 (3.8)	668 (4.5)	
IV	338 (6.6)	358 (6.7)	243 (5.5)	939 (6.3)	

AMI: acute myocardial infarction; PCI: percutaneous coronary intervention; CABG: coronary artery bypass surgery; STEMI: ST-segment elevation myocardial infarction; NSTEMI: non-ST-segment elevation myocardial infarction.

Table 2.
Angiographic characteristics

Characteristics	Period (procedures/arteries)				*p*-value
	2006-2008 (28,157/42,731)	2009-2011 (32,032/48,685)	2012-2016 (25,964/38,584)	Total (86,153/130,000)	
Extent of CAD, n (%)					< 0.0001
Two-vessel	18,296 (65.0)	20,781 (64.9)	16,891 (65.1)	55,968 (65.0)	
Three-vessel	9,861 (35.0)	11,241 (35.1)	9,024 (34.8)	30,126 (35.0)	
Multivessel + LMC	0 (0)	10 (0.03)	49 (0.19)	59 (0.07)	
Treated vessels, n (%)					< 0.0001
RCA	12,649 (29.6)	14,787 (30.4)	11,383 (29.5)	38,819 (29.9)	
LCx	11,602 (27.2)	12,818 (26.3)	10,626 (27.5)	35,046 (27.0)	
LAD	16,508 (38.6)	18,799 (38.6)	14,895 (38.6)	50,202 (38.6)	
Venous graft	1,554 (3.6)	1,728 (3.5)	1,157 (3)	4,439 (3.4)	
LMC	418 (1.0)	553 (1.1)	523 (1.4)	1,494 (1.1)	
Type B2/C lesions, n (%)	27,365 (70.1)	1,632 (78)	567 (88.5)	29,564 (70.8)	< 0.0001
Calcified lesions, n (%)	12,067 (28.2)	12,597 (25.9)	8,655 (22.4)	33,319 (25.6)	< 0.0001
Thrombotic lesions, n (%)	5,543 (13.0)	5,303 (10.9)	3,665 (9.5)	14,511 (11.2)	< 0.0001
Long lesions, n (%)	11,646 (27.3)	13,443 (27.6)	9,940 (25.8)	35,029 (26.9)	< 0.0001
Bifurcations, n (%)	11,787 (27.6)	12,064 (24.8)	8,108 (21.0)	31,959 (24.6)	< 0.0001
Chronic occlusions, n (%)	5,281 (12.4)	5,709 (11.7)	4,282 (11.1)	15,272 (11.8)	< 0.0001
Pre-procedural TIMI flow, n (%)					< 0.0001
0/1	7,239 (16.9)	6,779 (13.9)	5,373 (13.9)	19,391 (14.9)	
2/3	35,486 (83.1)	41,898 (86.1)	33,202 (86.1)	110,586 (85.1)	
Left ventricular dysfunction, n (%)	13,956 (59.8)	13,905 (61.9)	10,697 (62.5)	38,558 (61.3)	< 0.0001
Collateral circulation, n (%)	4,111 (15.1)	2,896 (15.2)	2,004 (12.4)	9,011 (14.4)	< 0.0001

CAD: coronary artery disease; LMC: left main coronary artery; RCA: right coronary artery; LCx: left circumflex artery; LAD: left anterior descending artery; TIMI: Thrombolysis in Myocardial Infarction.

Table 3
Characteristics of percutaneous coronary interventions

Characteristics	Period (patients/procedures)				*p*-value
	2006-2008 (25,806/28,157)	2009-2011 (29,894/32,032)	2012-2016 (24,393/25,964)	Total (80,093/86,153)	
Treated vessels/patient	1.7 ± 0.9	1.6 ± 0.8	1.6 ± 0.8	1.6 ± 0.8	< 0.0001
Stent use, n (%)	24,781 (96.0)	28,813 (96.4)	23,579 (96.7)	77,173 (96.4)	0.0007
Stents per patient	1.7 ± 0.8	1.7 ± 0.8	1.7 ± 0.8	1.7 ± 0.8	0.0011
Drug-eluting stents, n (%)	8,702 (21.3)	14,455 (30.1)	13,327 (33.6)	36,484 (28.4)	< 0.0001
Stent diameter, mm	3.0 ± 0.47	2.98 ± 0.48	2.94 ± 0.49	2.98 ± 0.48	< 0.0001
Stent length, mm	19.2 ± 6.8	20 ± 7.7	20.3 ± 8.0	19.8 ± 7.6	< 0.0001
Types of intervention, n (%)					< 0.0001
Primary PCI	3,432 (12.2)	3,646 (11.4)	2,634 (10.1)	9,712 (11.3)	
Rescue PCI	359 (1.3)	123 (0.4)	116 (0.4)	598 (0.7)	
Glycoprotein IIb/IIIa inhibitor, n (%)	2,042 (7.3)	1,197 (3.7)	568 (2.2)	3,807 (4.4)	< 0.0001
Thromboaspiration, n (%)	72 (0.2)	302 (0.6)	261 (0.7)	635 (0.5)	< 0.0001
Post-procedural TIMI flow, n (%)					< 0.0001
0/1	946 (2.3)	679 (1.4%)	393 (1.0)	2,018 (1.6)	
2/3	39,999 (97.7)	47,312 (98.6)	39,219 (99.0)	126,530 (98.4)	
Diameter stenosis, %					
Pre	85.6 (12.5)	85.2 (13)	85.6 (14.2)	85.4 (13.2)	< 0.0001
Post	2.7 (11.4)	2.6 (7.7)	5.1 (5.0)	3.4 (8.5)	< 0.0001
Procedural success, n (%)	26,949 (95.7)	31,082 (97.1)	25,323 (97.6)	83,354 (96.8)	< 0.0001

PCI: percutaneous coronary intervention; TIMI: Thrombolysis in Myocardial Infarction.

Table 4
Clinical outcomes during hospitalization

Outcome	2006-2008 (n = 25,806)	2009-2011 (n = 29,894)	2012-2016 (n = 24,393)	Total (n = 80,093)	*p*-value
AMI, n (%)	148 (0.6)	80 (0.3)	46 (0.2)	274 (0.4)	< 0.0001
Emergency revascularization, n (%)	3 (0.14)	17 (0.07)	9 (0.04)	29 (0.06)	0.18
Death, n (%)	402 (1.6)	274 (1.0)	251 (1.1)	927 (1.2)	< 0.0001
MACE, n (%)	519 (2.0)	357 (1.2)	294 (1.2)	1.170 (1.5)	< 0.0001

* Comparison between quartiles. AMI: acute myocardial infarction; MACE: major adverse cardiac events.

Table 5
Predictive factors of in-hospital death (univariate analysis)

Factor	*p*-value	OR	95% CI
2006-2008 vs. 2009-2011	< 0.0001	1.58	1.35-1.84
2012-2016 vs. 2009-2011	0.14	1.14	0.96-1.35
Age, years	< 0.0001	1.05	1.04-1.06
Sex, female vs. male	< 0.0001	1.45	1.27-1.66
Diabetes mellitus, yes vs. no	0.0001	1.33	1.16-1.53
Previous myocardial infarction, yes vs. no	0.021	1.20	1.03-1.41
Clinical manifestation, STEMI vs. stable angina	< 0.0001	12.20	10.05-14.8
Clinical manifestation, STEMI vs. silent ischemia	< 0.0001	6.09	4.65-7.98
Clinical manifestation, STEMI vs. NSTEMI	< 0.0001	3.68	3.22-4.21
Killip class, I vs. IV	< 0.0001	0.02	0.02-0.03
Killip class, II vs. IV	< 0.0001	0.09	0.07-0.11
Killip class, III vs. IV	< 0.0001	0.25	0.19-0.33
Extent of coronary disease, three-vessel vs. two-vessel	< 0.0001	2.64	2.31-3.01
Extent of coronary disease, multivessel + LMC vs. two-vessel	0.058	7.00	0.93-52.54
Left ventricular dysfunction, yes vs. no	< 0.0001	9.08	6.37-12.92
Collateral circulation, yes vs. no	< 0.0001	2.08	1.76-2.46
Type of intervention, primary vs. other	< 0.0001	10.14	8.87-11.6
Type of intervention, rescue vs. other	< 0.0001	11.38	7.97-16.26
Glycoprotein IIb/IIIa inhibitor, yes vs. no	< 0.0001	4.85	4.09-5.75

OR: odds ratio; 95% CI: 95% confidence interval; STEMI: ST-segment elevation myocardial infarction; NSTEMI: non-ST-segment elevation myocardial infarction; LMC: left main coronary artery.

Table 6
Predictive factors of in-hospital death (multivariate analysis)

Factor	*p*-value	OR	95% CI
2006-2008 vs. 2009-2011	< 0.0001	1.61	1.36-1.91
2012-2016 vs. 2009-2011	0.76	1.03	0.84-1.26
Age, years	< 0.0001	1.04	1.03-1.05
Sex, female vs. male	0.0060	1.24	1.06-1.44
Diabetes mellitus, yes vs. no	0.0003	1.33	1.14-1.56
Previous myocardial infarction, yes vs. no	< 0.0001	1.68	1.41-2.01
Extent of coronary disease, three-vessel vs. two-vessel	< 0.0001	2.02	1.74-2.33
Extent of coronary disease, multivessel + LMC vs. two-vessel	< 0.0001	28.63	1.37-597.47
GP IIb/IIIa inhibitors, yes vs. no	< 0.0001	1.70	1.4-2.07
Clinical manifestation, STEMI vs. stable angina	< 0.0001	4.57	3.34-6.24
Clinical manifestation, STEMI vs. silent ischemia	< 0.0001	2.64	1.744
Clinical manifestation, STEMI vs. NSTEMI	0.0056	1.52	1.162
Type of intervention, primary vs. other	< 0.0001	4.23	3.145.69
Type of intervention, rescue vs. other	< 0.0001	4.59	2.887.32

OR: odds ratio; 95% CI: 95% confidence interval; LMC: left main coronary artery; GP: glycoprotein; STEMI: ST-segment elevation myocardial infarction; NSTEMI: non-ST-segment elevation myocardial infarction.

women constitute approximately one-third of treated patients and exhibit a poorer prognosis than men, possibly due to a higher prevalence of small vessels and the number of comorbidities.[19] Lichtman et al. also found that the influence of sex does not depend on age and that younger women have an even worse prognosis.[13] Lopes et al. studied the results of PCI in the country with respect to sex by consulting data from the CENIC registry between 1999 and 2007.[20] In their analysis, the women were older and had a higher prevalence of diabetes mellitus, had more favorable angiographic characteristics and received implanted stents with smaller diameters more often. The authors showed that women exhibited higher rates of death (1.20% vs. 0.79%; $p < 0.0001$) and non-fatal AMI (0.54% vs. 0.41%; $p < 0.0001$) compared to men. The authors concluded that these findings were probably due to more advanced age, smaller vessels and worse vascular remodeling.

In contrast to international registries and studies, data regarding the results of PCI in Brazil are scarce. Therefore, advancements are necessary for the development and growth of this field in Brazil. Piegas et al. assessed coronary procedures performed between 2005 and 2008 by consulting the Unified Health System's Informatics Department database (DATASUS, acronym in Portuguese).[21] The 166,514 procedures retrieved within the above period, with no mention of the extent of coronary artery disease, resulted in a reported in-hospital mortality of 2.33%, a mortality of 0.86% in elective cases, and a mortality of 3.25% in emergency procedures.

The first reported series using the CENIC registry assessed the procedures performed immediately after the beginning of data collection, between 1992 and 1993.[5] A total of 19,305 balloon PCI were assessed, and in-hospital mortality was 1.8%. Subsequently, cases from 1996 to 1997, immediately after the introduction of coronary stents, were analyzed.[7] Of the 25,854 analyzed procedures, 38.5% were performed on patients with multivessel disease, and stents were used in 36% of the cases. The reported mortality was 1.4%. Therefore, this angiographic profile reflects an increase in the number of interventions. In 1996/97, patients with multivessel disease accounted for 38.5% of the sample. In the present study, these patients accounted for 45.3% of the sample.

De Paula et al. published in-hospital results of PCI performed in six Brazilian national centers.[22] A total of 1,239 patients were consecutively included in 2009. In 61.5% of the cases, the indication for the procedure was acute coronary syndrome. Hospital mortality was 2.3%. Among patients with ST-segment elevation myocardial infarction, the mortality rate was 6.1%; this rate was 2.4% among those with non-ST-segment elevation myocardial infarction and 0.2% among those with a stable presentation. In Brazil, the results of PCI performed in eight regional centers were analyzed by Lodi-Junqueira et al.[23] The authors identified the presence of multivessel coronary disease as a predictive factor of hospital death (55.7% of patients had multivessel disease, with 1.9% of deaths among patients with two-vessel disease and 3.9% among those with three-vessel disease).

We found that the mortality rate of PCI in Brazil ranged between 1.2% and 2.3%, and it was higher among patients with acute coronary syndrome. These findings are reproducible compared with international data. However, there are also differences. Stent implantation was the standard technique (96.4% of procedures), but the use of drug-eluting stents was low. Although decreasing, the difference in the use of this device in Brazil in relation to the world practice, estimated between 80 to 90%, is still unsatisfactory.[9,14] The lower use of drug-eluting stents in Brazil is related to the current cost of endoprostheses. Considering the possible decline in the rate of cardiovascular events through the use of new-generation drug-eluting stents,[24-29] these devices should be implemented more frequently in our country, especially among patients with multivessel disease.

There are some limitations to the use of mortality rates as indicators of quality of care in interventional cardiology. PCI-related mortality is determined as death caused by complications of the procedure, such as perforation or dissection, stent thrombosis, bleeding and kidney failure. Valle et al. found a mortality rate of 1.54% among 5,520 patients undergoing PCI in a single center between 2001 and 2009. The cause of death was determined as secondary to complications of the procedure in only 8.2% of the cases. In the remaining cases, death was due to pre-existing causes or those acquired after the procedure (heart failure, arrhythmias or neurological complications).[17] Therefore, predicting cardiovascular outcomes after PCI is more accurate when the general and neurological conditions of a patient are considered in addition to baseline cardiovascular variables given that more than half of deaths were not due to cardiac causes or to the procedure itself.[13]

The results of PCI in patients with multivessel disease are affected by many factors. Improvements in treatment are related to advancements in technology and antithrombotic therapy, more efficient pharmacological agents and intravascular imaging, greater operator experience and recognition of predictors of complications prior to procedures.[30] In fact, international registries show reduced rates of adverse cardiovascular outcomes after the introduction of these improvements, which have remained stable over time.[24]

Our study has some limitations. The voluntary nature of the CENIC registry and the absence of inclusion criteria at each center may reflect a selection bias. The data were not audited, and the SBHCI does not have a primary lab to perform independent angiographic analyses. Consequently, the patients were not stratified according to an anatomical severity score. Data regarding adjunctive pharmacotherapy with PCI were not analyzed. Similarly, the lengths of hospitalization and the rates of vascular complications, which are frequent in this population, are unknown. The results could be more accurately analyzed if they were stratified according to the type of hospital (secondary or tertiary) and the experience of the operator/center considering that greater experience is positively correlated with lower complication rates.[9,31]

Conclusions

Data from the CENIC registry show that percutaneous coronary intervention as a treatment modality for patients with multivessel disease is safe, efficient and reproducible. National results should be analyzed beyond hospitalization to obtain long-term data. The identification of characteristics associated with a poor prognosis can be useful for stratification and for the selection of the most appropriate treatment strategy.

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Conflicts of interest

The authors declare no conflicts of interest.

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