

Use of drug-eluting stents in Brazil: The CENIC (National Registry of Cardiovascular Interventions) Registry

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Summary

Background: Drug-eluting stents (DES) represent a major advance in the management of ischemic heart disease, but the extrapolation of favorable results from clinical trials to the real-world practice has been criticized.

Objective: To assess the use of DES in Brazil between 2000 and 2005.

Methods: Using the database of the National Registry of Cardiovascular Interventions (CENIC - Central Nacional de Intervenções Cardiovasculares) of the Brazilian Society of Hemodynamics and Interventional Cardiology (SBHCI - Sociedade Brasileira de Hemodinâmica e Cardiologia Intervencionista), all PCI procedures with DES implantation performed between 2000 and 2005 were analyzed. The groups were divided into the following biennia: 2000-2001 (A), 2002-2003 (B), and 2004-2005 (C), and patient's clinical and angiographic characteristics were compared, as well as their short-term clinical outcome. Statistical analyses were performed using the chi-square test or ANOVA, and p values of less than 0.05 were considered to be statistically significant.

Results: A total of 154,406 PCI procedures were studied, and DES was used in 10,426 (7%) interventions. A progressive and statistically significant increase was found in the use of DES during the period studied: 0.14% from 2000 to 2001, 5% from 2002 to 2003, and 14% from 2004 to 2005 ($p < 0.0001$). After 2001, there was an increase in success rates (96.58% in 2000-2001 (A), 99.69% in 2002-2003 (B), and 99.56% in 2004-2005 (C), A x B with $p < 0.001$; B x C with $p = 0.015$) and a decrease in hospital mortality rates (1.59% in group A, 0.38% in group B, and 0.66% in group C, with $p = 0.59$ for A x B and $p < 0.0001$ for B x C).

Conclusion: In Brazil, the use of drug-eluting stents increased significantly during recent years, resulting in higher success rates and lower hospital mortality. (Arq Bras Cardiol 2007;89(6):322-326)

Key words: Coronary arteriosclerosis; stents; coronary restenosis; drug-eluting stents.

Introduction

Over the past few years, drug-eluting stents (DES) have revolutionized the field of interventional cardiology. Thanks to the inhibition of neointimal hyperplasia by local delivery of antiproliferative drugs, these stents have proven to significantly decrease restenosis and target-lesion revascularization rates in the long-term follow-up¹. When patients at higher risk of restenosis are evaluated, such as diabetics with smaller vessels and long lesions, these benefits are even more impressive^{2,3}.

The profile of patients undergoing percutaneous coronary interventions (PCI) has changed in recent years, including more complex cases, as clearly illustrated by the greater risk of those with unstable angina⁴. Data from international literature show that DES⁵ implantation is more common in

these patients; however, little information exists in Brazilian literature concerning this topic. Therefore, the aim of this study was to determine the patterns of use of drug-eluting stents in patients who underwent PCI between 2000 and 2005.

Methods

CENIC registry – Data related to the procedures analyzed in this study were obtained from the National Registry of Cardiovascular Interventions (CENIC), maintained by the Brazilian Society of Hemodynamics and Interventional Cardiology. This registry contains cases sent voluntarily by members of the Society, which encourages its associates to complete and send to CENIC questionnaires providing detailed information about all coronary or valvular interventions they have performed. The CENIC registry form for PCI includes information regarding risk factors for ischemic heart disease, patients' clinical features, technical details about the intervention, and in-hospital clinical outcome. These data are sent in standard forms via the internet and regularly updated.

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Patient selection – All data related to the PCI with DES implantation included in this study were retrieved from the CENIC database between 2000 and 2005. In order to prevent any selection bias, no exclusion criteria was applied and all interventions using DES entered into the database were included in the study. The analyses were performed according to the year in which the procedure was performed: 2000-2001 (Group A), 2002-2003 (Group B), and 2004-2005 (Group C).

Characteristics analyzed – The following data collected from CENIC electronic forms were analyzed: age, gender, cardiovascular risk factors (diabetes, hypertension, smoking, dyslipidemia, and family history), clinical presentation, indication for PCI, ventricular function, number of vessels affected, treated vessel, type of lesion, success rate, and complications (death, vascular complications, myocardial infarction, and post-PCI renal failure).

Statistical analysis - Data are expressed as mean, standard deviation and percentage. Categorical variables were compared using the chi-square test, and continuous variables were analyzed using ANOVA. The significance level was set at < 0.05 .

Results

Between 2000 and 2005, a total of 154,406 percutaneous coronary interventions for coronary artery disease (CAD) were reported to the CENIC registry. Drug-eluting stents were used in 10,425 of them, accounting for about 7% of all stents implanted in this period. From 2000 to 2005, the use of DES increased significantly, as shown in Figure 1. In the 2004-2005 biennium, approximately 14% of the PCI procedures included implantation of a drug-eluting stent.

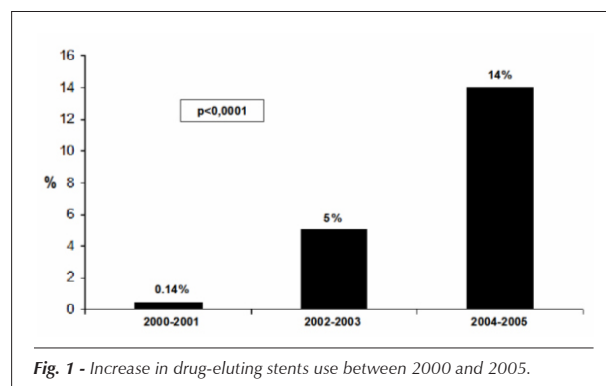


Fig. 1 - Increase in drug-eluting stents use between 2000 and 2005.

As for the patients' profile, a complex heterogeneous pattern was found, considering the characteristics studied. The risk profile worsened significantly in the 2002-2003 and 2004-2005 biennia, when compared to the 2000-2001 biennium, not only regarding risk factor prevalence, but also clinical stratification when the TIMI risk score was applied⁶. Clinical characteristics of the patients who underwent PCI are detailed in Table 1.

Despite the higher-risk clinical profile, angiographic patterns did not change significantly in the three biennia studied. Nevertheless, the number of single-vessel diseases and PCIs in venous/arterial grafts increased significantly over the last few years. Also noteworthy is the significant number

of lesions longer than 20 mm and the presence of branches involved in the interventions. Angiographic characteristics are shown in Table 2.

As far as clinical endpoints are concerned, our data revealed an increase in success rates and a decrease in complications. Mortality rate and post-PCI AMI have declined over the years. Procedural outcomes between 2000 and 2005 are described in Table 3.

Discussion

The aim of this study was to assess the changing patterns in drug-eluting stenting between 2000 and 2005 using data from the National Registry of Cardiovascular Interventions (CENIC). Other studies based on the CENIC registry have been published previously⁷⁻¹². Data on both elective procedures and cases of acute myocardial infarction have been reported earlier, which is important to disseminate what has been done by associate members of the SBHCl. However, information about the current status of PCI using DES is still lacking, and these figures are unknown. The results from the CRUSADE registry⁵ show that after DES was approved in the United States the number of PCI increased significantly, while the rates of clinical treatment and surgical revascularization decreased in patients with three-vessel disease. According to CENIC data, a similar finding was found in our country. The number of implanted DES increased progressively in Brazil, and in the 2004-2005 biennium, it was used in 14% of the interventions.

Even though drug-eluting stents significantly reduce restenosis in high-risk patients, their growing use has extrapolated the on-label indications to off-label and even untested indications^{13,14}. This has a high financial burden, and the cost-effectiveness of these devices is currently a matter of debate¹⁵. Even in first-world countries, such as Spain, the use of DES is associated with a significant increase in healthcare system costs¹⁶. In Brazil, the same concerns have been raised. Impact models have demonstrated that the cost for the public health system (SUS) is likely to increase between 12.8% and 24.4%, making this an expensive strategy for the Brazilian reality^{17,18}. If large vessels (> 3.5 mm) were taken into account, for example, little clinical benefit would be added with the systematic use of DES, and costs would be significantly elevated¹⁹. Therefore, although DES is becoming increasingly used in Brazil, its cost-benefit ratio should be better evaluated.

Risk factor prevalence has changed after the 2000-2001 biennium, with an increase in hypertension, smoking, and dyslipidemia, as well as in previous AMI, PCI, and CABG. The risk profile of patients treated for acute ischemic syndrome also changed significantly. When the TIMI risk was applied, the number of patients with moderate-to-high risk unstable angina rose progressively. This worsening clinical profile might have justified the increased use of drug-eluting stents, since these stents have been shown to reduce clinical and angiographic restenosis in patients with complex coronary artery disease²⁰⁻²².

In-hospital mortality among patients undergoing PCI can be estimated based on clinical and angiographic characteristics of greater risk²³. Despite the worst clinical profile, a small yet significant increase was found in the success rate. Conversely,

Table 1 – Clinical characteristics of patients undergoing percutaneous intervention with drug-eluting stents between 2000 and 2005.

	2000-2001 (A)	2002-2003 (B)	2004-2005 (C)	p (A x B)	p (A x B)
Risk factors (%)					
Men	66.14	73.14	69.90	0.03	0.001
Age	67 (36-93)	65 (26-97)	64 (8-97)	NS	NS
Diabetes	97.62	36.93	66.94	<0.001	0.003
Hypertension	0	67.04	81.30	<0.0001	<0.0001
Smoking	0	23.13	24.85	0.0004	0.12
Dyslipidemia	2.38	58.02	67.97	<0.001	<0.001
Family history	2.30	37.95	39.62	0.0001	0.18
Previous AMI	11.90	26.03	23.94	0.03	0.06
Previous PCI	8.47	27.13	30.29	<0.0001	0.002
Previous CABG	7.94	17.49	15.98	0.0007	0.06
Clinical presentation (%)					
Asymptomatic	5.29	12.83	12.11	0.002	0.33
Stable angina	26.46	36.27	38.01	0.006	0.10
Non-ST-elevation ACS	57.67	40.41	40.69	<0.0001	0.79
Low risk	80.73	42.83	20.30	<0.0001	0.0001
Moderate risk	11.01	28.68	35.21	<0.0001	<0.0001
High risk	8.26	28.49	44.49	<0.0001	<0.0001
AMI	10.58	10.50	9.18	0.97	0.04
Killip I-II	90	93.64	95.26	0.48	<0.0001
Killip III-IV	10	6.36	4.74	0.48	0.38
Ventricular function (%)					
Normal	40.74	44.54	46.81	0.60	0.04
Dysfunction					
Mild-to-moderate	48.67	42.1	36.1	0.07	<0.0001
Severe	6.35	3.54	3.59	0.04	0.081
Undefined	4.23	9.82	13.50	0.01	<0.0001

AMI - acute myocardial infarction; PCI - percutaneous coronary intervention; CABG - coronary artery bypass grafting; ACS - acute coronary syndrome.

the incidence of complications declined and, after the 2000-2001 biennium, there was a significant reduction in hospital deaths, vascular complications and post-PCI AMI. These findings cannot be attributed solely to the use of drug-eluting stents, and may be related to overall improvement in PCI technique and the material employed, as well as to higher quality training of new interventionists and the promotion of continued medical education.

Study limitations – Some limitations of this study must be acknowledged. CENIC data are submitted voluntarily by SBHCl associate members; therefore a great number of procedures are not reported to the database. Therefore, these interventions might have been underrepresented. On the other hand, it must be noted that a considerable number of PCI procedures

were studied, probably accounting for a significant sample of the interventions performed in Brazil. Drug-eluting stents are not covered by the public health system, which precludes their widespread use. This technology is available only for patients with private health insurance plans, meaning that drug-eluting stents are available to only part of the Brazilian population. The lack of long-term follow-up limits any conclusion regarding late outcome in DES-treated patients. This fact is relevant, since an increase in mortality rates has been related to DES implantation for off-label indications²⁴.

Conclusion

In Brazil, the use of drug-eluting stents increased

Table 2 – Angiographic characteristics of patients undergoing percutaneous intervention between 2000 and 2005.

	2000-2001 (A)	2002-2003 (B)	2004-2005 (C)	p (A x B)	p (A x B)
N° of vessels affected (%)					
One	32.80	45.49	42.51	0.0007	0.006
Two	45.50	32.02	34.72	<0.0001	0.011
Three	21.69	22.50	22.76	0.79	0.78
Vessels affected (%)					
LAD	35	38.34	39.9	0.36	0.08
CX	8.4	21.85	21.38	0.89	0.53
RC	33.5	27.33	25.73	0.014	0.048
LMCA	0.87	1.78	1.62	0.21	0.48
Venous and arterial graft	1.67	3.51	4.06	0.020	0.12
Others	6.41	7.16	7.31	0.61	0.70
Lesion type					
A	2.92	5.53	3.41	0.03	<0.0001
B1	26.24	30.73	29.58	0.08	0.18
B2	40.82	39.06	36.92	0.52	0.01
C	30.03	24.69	30.09	0.02	<0.0001
> 20 mm in length	47.23	49.07	35.73	0.51	<0.001
Branch involved	28.86	28.48	29.91	0.014	0.09

LAD - left descending artery; CX - circumflex artery; RC - right coronary artery; LMCA - left main coronary artery; A, B1, B2, C - lesion type according to the AHA/ACC classification.

Table 3 – Procedural outcomes from 2000 to 2005.

	2000-2001 (A)	2002-2003 (B)	2004-2005 (C)	p (A x B)	p (A x B)
Success	96.58	99.69	99.56	<0.001	0.015
Death	1.59	0.38	0.21	0.05	0.22
Post-PCI AMI	1.06	0.15	0.30	0.008	0.18
ARF	0.53	0.87	0.12	0.62	<0.0001
Vascular complication	1.05	1.55	0.66	0.59	<0.0001

AMI - acute myocardial infarction; PCI - percutaneous coronary intervention; ARF - acute renal failure.

significantly over the last years. These devices have been used in patients with conditions of varying complexities, resulting in increased success rates and reduced hospital deaths.

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Potential Conflict of Interest

No potential conflict of interest relevant to this article

was reported.

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Study Association

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