

# Primary Coronary Angioplasty in 9,434 Patients During Acute Myocardial Infarction: Predictors of Major In-hospital Adverse Events From 1996 to 2000 in Brazil

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**Objective** - To verify the results after the performance of primary coronary angioplasty in Brazil in the last 4 years.

**Methods** - During the first 24 hours of acute myocardial infarction onset, 9,434 (12.2%) patients underwent primary PTCA. We analyzed the success and occurrence of major in-hospital events, comparing them over the 4-year period.

**Results** - Primary PTCA use increased compared with that of all percutaneous interventions (1996=10.6% vs. 2000=13.1%;  $p<0.001$ ). Coronary stent implantation increased (1996=20% vs. 2000=71.9%;  $p<0.001$ ). Success was greater (1998=89.5% vs. 1999=92.5%;  $p<0.001$ ). Reinfarction decreased (1998=3.9% vs. 99=2.4% vs. 2000=1.5%;  $p<0.001$ ) as did emergency bypass surgery (1996=0.5% vs. 2000=0.2%;  $p=0.01$ ). In-hospital deaths remained unchanged (1996=5.7% vs. 2000=5.1%,  $p=0.53$ ). Balloon PTCA was one of the independent predictors of a higher rate of unsuccessful procedures (odds ratio 12.01 [CI=95%] 1.58-22.94), and stent implantation of lower mortality rates (odds ratio 4.62 [CI=95%] 3.19-6.08).

**Conclusion** - The success rate has become progressively higher with a significant reduction in reinfarction and urgent bypass surgery, but in-hospital death remains nearly unchanged. Coronary stenting was a predictor of a lower death rate, and balloon PTCA was associated with greater procedural failure.

**Keywords:** coronary angioplasty, myocardial infarction, stents

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The last decade of the year 2000 witnessed a remarkable improvement in the treatment of acute myocardial infarction (AMI)<sup>1</sup>. In the first years of the 1980s, primary (without previous use of fibrinolytics) percutaneous transluminal coronary angioplasty (PTCA) was introduced as a new clinical option for reperfusion in the setting of AMI in Brazil. Use of this procedure progressively increased in all Brazilian territories, with a growing number of invasive cardiology centers adopting the mechanical reperfusion technique as the main treatment for patients with AMI<sup>2,3</sup>.

Randomization series and systematic reviews that had compared primary PTCA with fibrinolytics reinforced the better acute and long-term results obtained with mechanical reperfusion used in patients with AMI<sup>4,5</sup>. The Brazilian Society of Intervention Cardiology (SBHCI) and the Central Nacional de Intervenções Cardiovasculares (CENIC) have already demonstrated that primary PTCA in AMI comprises 11% of the total sum of percutaneous coronary interventions (PCI) performed in Brazil. Since 1996, coronary stenting has been progressively adopted during primary PTCA procedures, and since 1997, the intravenous infusion of abciximab, an inhibitor of the platelet glycoprotein IIb/IIIa inhibitors<sup>3,6</sup>, has increased.

However, until now, we have not had a temporal analysis regarding the results of primary PTCA in Brazil, and the impact of that on the reduction of the occurrence of major adverse cardiac events. Also, it is important to verify the influence of the progressively frequent adoption of new percutaneous (stenting) and pharmacological (abciximab) strategies, either in procedural success or in the reduction of the main adverse outcomes after AMI occurrence<sup>7-9</sup>.

From the Brazilian PCI nationwide databank (CENIC), we analyze the performance of primary PTCA during the last four years (1996-2000), verifying the success rate and the occurrence of major in-hospital adverse cardiac events.

## Methods

From January 1996 until December of 2000, the CENIC databank gathered the information sent by 215 invasive cardiologists from Brazil, regarding 77,071 PCI procedures performed by these physicians in 185 different invasive cardiology centers, representing all the geographic regions of the country. The PCI procedure was sent to the CENIC coordinating center by conventional or electronic mail, on a standard database sheet, reporting the clinical, angiographic, and procedural results, as was the occurrence of major in-hospital adverse cardiac events.

We analyzed those data sheets that indicated that primary PTCA was performed without prior use of fibrinolytics in the first 24 hours of AMI symptom onset. During the 4 years in question, 9,434 (12.2%) patients underwent a primary PCI during AMI, and their data were then analyzed.

The pharmacological (abciximab) and invasive procedures were performed according to the daily routine of each center. The global analysis of the files demonstrated that more than 90% of the patients received aspirin and ticlopidine plus intravenous heparin. Coronary stents were implanted at the operator's discretion. All coronary stents were deployed with high-pressure balloon inflation (>10 ATM). Left ventricular function was analyzed with a qualitative method, as was the diameter of the stenosis in the culprit AMI vessel. Primary PTCA success was defined as a final diameter stenosis less than 50% with TIMI 2 or 3 flow<sup>10</sup>, and the occurrence of reinfarction, emergency bypass surgery, new urgent PTCA, or hospital death were analyzed comparatively, from 1996 until 2000.

The categorical variables are depicted as absolute numbers, and their percentages and the continuous variables are depicted as averages and standard deviation.

We used the variance analysis test (ANOVA) for the continuous variables. To localize differences between 2 continuous variables, the Tukey method of multiple comparisons was then applied. The chi-square test was used to analyze the categorical variables, with Fisher's exact test applied when necessary. For the multivariate analysis, we selected the variables that had a p<0.10 value in the univariate method, then included them in a model of progressive multiple logistic regression analysis. The method identifies the odds ratio and their respective confidence interval. The p<0.05 was considered a significant difference. The statisti-

cal package used to obtain all these evaluations was SPSS version 9.0 for Windows.

## Results

Over the 4-year period, we observed a significant growing use of primary PTCA in Brazil, with a 5% increase per year, when compared with all PCI procedures performed in the same period of time (tab. I). Only in the comparison of the years 1998 with 1999, did no significant increase occur in the number of primary PCI procedures performed in the first 24 hours of AMI onset.

The demographics of this population of patients suffered significant modifications during the time analyses. The mean age increased by 2 years on average, from 1996 until 2000 (59.2±10 years to 61.2±15 years; p<0.001). Regarding gender analysis, a trend existed toward the more frequent treatment of female patients, from 1996 to 2000 (30% versus 31.6%; p=0.08). The incidence of diabetes increased from 11.4% (1997) to 16.3% (2000; p<0.001), but a significant reduction was observed in relation to patients treated that had had previous coronary bypass surgery (1996, 5.2%, versus 2000, 4.6%; p=0.01). Anterior wall MI was observed in nearly 50% of the whole population; on average, 8% of patients had undergone a previous PTCA. These variables did not change significantly during the period of time analyzed (tab. II).

The angiographic characteristics of the patients also had significant differences during the 4-year period. The number of patients with multivessel coronary heart disease increased (1996, 41%, versus 2000, 45.7%; p<0.001), but a decrease in the patients with moderate and severe left ventricular contractile dysfunction was observed (1996, 49.4%,

**Table I - Temporal analysis from 1996 to 2000, demonstrating the application of primary PTCA in Brazil, compared to all percutaneous coronary interventions performed in the same period of time**

	1996	1997	1998	1999	2000	P
Total - PCI	11,526	13,575	15,192	16,841	19,937	<0.001
Primary PTCA	1,223 (10.6%)	1,600 (11.7%)	1,895 (12.4%)	2,097# (12.4%)	2,619 (13.1%)	<0.001

PCI- percutaneous coronary intervention; PTCA- percutaneous transluminal coronary angioplasty; \* p=0.95, 1999 vs. 1998.

**Table II - Clinical profile the patients who underwent primary PTCA from 1996 to 2000 in Brazil**

	1996	1997	1998	1999	2000	p
Mean age (years)	59.2 ± 10	59.4 ± 14	59.5 ± 15	60.5 ± 16	61.2 ± 15	<0.001
Female gender	367 (30%)	449 (28%)	542 (28.6%)	609 (29%)	829 (31.6%)	0.08
Diabetics	NR	183(11.4%)	292 (15.4%)	365 (17.4%)	427 (16.3%)	<0.001
Previous events PTCA	97 (7.9%)	146 (9.1%)	163 (8.6%)	185 (8.8%)	200 (7.6%)	0.40
Bypass surgery	64 (5.2%)	112 (7%)	118 (6.2%)	125 (6%)	120 (4.6%)	0.01
Anterior MI	625 (51.1%)	866(54.1%)	1,006(53.1%)	1,124(53.6%)	1,411(53.8%)	0.52

MI- myocardial infarction; PTCA- percutaneous transluminal coronary angioplasty; NR- not reported.

versus 2000, 44.5%;  $p=0.002$ ). The culprit AMI vessel did not change significantly in this current analysis, with a predominance of total occlusions presenting before primary PTCA performance (tab. III).

Coronary stent implantation grew significantly during this period of time, year by year, from 20% in 1996, to 71.9% in 2000 ( $p<0.001$ ). In the same fashion, abciximab intravenous infusion increased from 6.8% in 1996 to 24.6% in 2000 ( $p<0.001$ ) (tab. IV).

The primary PTCA success rate significantly increased from 87.2% in 1996 to 92.6% in 2000 ( $p<0.001$ ). In the comparative analysis performed for each year, we observed that the significant difference was observed in the comparison of the years 1998 with 1999. In the other years' comparisons, no significant differences were observed (tab. IV).

The necessity for an AMI patient to undergo urgent coronary artery bypass graft surgery after an unsuccessful primary PTCA was nearly eliminated (1996, 0.5%, versus 2000, 0.2%;  $p=0.01$ ) and the reinfarction rate progressively and significantly decreased from 3.2% in 1996; to 2.4% in 1999 and 1.5% in 2000 ( $p<0.001$ ). The need for new urgent PTCA remained in the same range during this 4-year period, 0.5% (NS). The in-hospital death rate was not significantly different throughout the 4 years, even in the comparison made in each year (tab. IV).

The logistic regression analysis (tab. V) identified the independent variables related to an unsuccessful procedure and to the occurrence of major cardiac events. The increasing age of the patients was a predictor of a procedural failure and death, female sex of higher mortality. Diabetic patients had a lower success rate and a higher occurrence of death. Patients with multivessel coronary heart disease had more unsuccessful procedures and higher reinfarction and mortality rates. Balloon PTCA was an independent predictor of the occurrence of all major adverse cardiac events, with the exception of the need to perform urgent bypass surgery. The performance of balloon PTCA, without coronary stent implantation, increased the chances of an unsuccessful procedure 12 times ( $OR=12.01$ ), and the in-hospital death rate 4 times ( $OR=4.69$ ). The presence of moderate and severe left ventricular contractile dysfunction predisposes patients to the occurrence of all major cardiac events, including the failure of the procedure and the need to undergo urgent coronary bypass surgery. In this model of multivariate analysis, primary PTCA with abciximab did not predict a higher success rate ( $p=0.61$ ; 95%  $CI=0.51-5.89$ ), diminish reinfarction ( $p=0.59$ ; 95%  $CI=0.53-3.61$ ), the performance of urgent bypass surgery ( $p=0.08$ ; 95%  $CI=0.72-4.95$ ) or death ( $p=0.84$ ; 95%  $CI=0.20-1.86$ ).

Table III - Angiographic profile the patients who underwent primary PTCA from 1996 to 2000 in Brazil

	1996	1997	1998	1999	2000	P
Multivessel coronary disease	502 (41%)	711 (44.4%)	862 (45.4%)	1,058 (50.4%)	1,198 (45.7%)	<0.001
Culprit MI vessel						0.53
Left anterior descending	616 (50.4%)	848 (53%)	987 (52.1%)	1,111 (53%)	1,392 (53.1%)	
Right coronary and left circumflex	583 (47.8%)	713 (44.8%)	855 (45.4%)	924 (44.4%)	1,163 (44.7%)	
Vein graft	24 (1.8%)	39 (2.2%)	53 (2.5%)	62 (2.6%)	64 (2.2%)	
Moderate + severe LV dysfunction	605 (49.4%)	803 (50.2%)	924 (48.1%)	997 (47.5%)	1,167 (44.5%)	0.002
TIMI flow (pre) 0 + 1	1,112 (91%)	1,445 (90.3%)	1,734 (91.5%)	1,929 (91.9%)	2,357 (89.9%)	0.13

LV- left ventricular.

Table IV - Procedural results and occurrence of major in-hospital adverse cardiac events in patients who underwent primary PTCA in Brazil during the years 1996 to 2000

	1996	1997	1998	1999	2000	P
Coronary stent implantation	244 (20%)	953(34.6%)	918 (48.5%)	1,138 (54.3%)	1,882 (71.9%)	<0.001
Abciximab usage	NR	83 (6.8%)	165 * (10.3%)	338 ** (17.8%)	645 (24.6%)	<0.001
PCI success	1,067(87.2%)	1,417(88.5%)	1,697 (89.5%)	1,940 ** (92.5%)	2,426 (92.6%)	<0.001
%DS pre	95.4 ± 5%	94.2 ± 8%	95.6 ± 4%	95.5 ± 6%	94.1 ± 5%	<0.001
%DS post	25.5 ± 15%	24.2 ± 18%	24.4 ± 12%	19.5% ± 16% **	19.1 ± 16%	<0.001
Emergency Bypass surgery	6 (0.5%)	11 (0.7%)	4 * (0.2%)	3 (0.1%)	5 (0.2%)	0.01
Urgent PTCA	8 (0.6%)	10 (0.6%)	9 (0.5%)	5 (0.2%)	14 (0.5%)	0.39
Reinfarction	39 (3.2%)	55 (3.4%)	75 (3.9%)	51 (2.4%) **	39 (1.5%)	+<0.001
Death	70 (5.7%)	100 (6.2%)	109 (5.7%)	126 (6%)	133 (5.1%)	0.53

DS - diameter stenosis; NR- not reported; PTCA- percutaneous transluminal coronary angioplasty; PCI- percutaneous coronary intervention. \* $p=0.03$ , 1998 vs. 1997; \*\* $p=0.008$ , 1999 vs. 1998; +  $p=0.02$ , 2000 vs. 1999.

Table V - Predictors of procedural failure and of the occurrence of major in-hospital adverse cardiac events obtained by a progressive logistic regression analysis			
Events	Variables	p	OR (IC/95%)
Primary PTCA failure	Age (by decade)	0.02	4.04 (2.26-5.79)
	Diabetes	0.002	2.85 (2.61-4.10)
	Multivessel coronary disease	0.04	1.70 (1.31-3.11)
	Moderate and severe LV dysfunction	<0.001	6.99 (6.91-7.11)
	Balloon PTCA	<0.001	12.01 (1.58-22.94)
Reinfarction	Multivessel coronary disease	<0.001	2.55 (1.32-3.59)
	Moderate and severe LV dysfunction	<0.001	3.91 (2.80-4.89)
	Balloon PTCA	<0.001	3.10 (1.70-4.45)
Emergency surgery	Moderate and severe LV dysfunction	0.01	3.40 (2.53-4.26)
Death	Age (by decade)	<0.001	4.88 (1.71-8.09)
	Female gender	0.001	2.59 (1.82-3.35)
	Diabetes	<0.001	4.35 (3.56-5.21)
	Multivessel coronary disease	<0.001	5.93 (3.97-7.90)
	Moderate and severe LV dysfunction	<0.001	11.50 (1.71-21.83)
	Balloon PTCA	<0.001	4.62 (3.19-6.08)

PTCA- percutaneous transluminal coronary angioplasty; LV- left ventricular.

## Discussion

The temporal analysis after the performance of primary PTCA documented in the Brazilian National PCI Registry (CENIC), from 1996 to 2000, demonstrated that its use had significantly and progressively increased, obtaining better results over almost all 4 years.

The number of mechanical reperfusion procedures in AMI (primary PTCA) increased approximately 20%, when compared with the number of PCI procedures performed in Brazil in the same period of time. This increase was constant throughout the 4 years. The favorable results observed in the analysis of the acute and late results after primary PCI, obtained from randomized series and from the large national registries, may have contributed to this significant increase<sup>4,5</sup>. According to previous reports from CENIC, primary PTCA is the main PCI procedure, being performed in almost 11% of AMI patients in Brazil. Elective PTCA after systemic fibrinolytics or indicated as a rescue procedure occurred on a much smaller scale, 3% and less than 1%, respectively<sup>3</sup>.

We noted significant modifications in the clinical and angiographic demographics of these 9,434 patients, throughout the 4 years. The mean age of the population increased steadily by 2 years per year analyzed. The last annual demographic census demonstrated that the Brazilians had a progressively longer life expectancy<sup>11</sup>. In 1999, the Brazilians greater than 60 years of age already constituted 10% of the entire population, an increase of 14.5%, compared with the data from 1995. Probably also a significant elevation in the incidence of other risk factors related to the presence of more extensive coronary heart disease, such as diabetes and multivessel disease, were the result of the increased elderly population. Patients' sex, previous revascularization procedures, and AMI location did not vary significantly over the years, except for a decrease in the treatment of patients with previous coronary bypass surgery. These characteristics were according to recent trends

observed in the data of large national registries and of mega international randomized trials<sup>12</sup>. We can assume that the Brazilian primary PTCA population profile is at moderate risk for the occurrence of major adverse events, and that until now, this 4-year analysis has not identified a profound modification in the patients' profiles that may have a significant influence on the acute results of the procedure.

However, the procedural and technical profile of primary PCI suffered significant modifications during the 4 years. The increasing adoption of coronary stenting in PCI performed in AMI patients is significant as noted in the CENIC registry. This is probably related to better acute (minimal residual stenosis) and long-term results (less restenosis and new target vessel revascularization rates), reported in randomized data that compared stenting to balloon PTCA<sup>6,13,14</sup>. Currently, coronary stents are the main percutaneous devices used in primary PCI, being implanted in more than 70% of patients. It is noteworthy that with the use of coronary stenting in 50% of the primary PCI in 1999, the success of the procedure did not increase more (>93%).

The use of intravenous infusion of abciximab, a potent IIB/IIIa inhibitor, that promotes a profound blockage of platelet aggregation, is also significant and has been constantly increasing since 1997. Its use is supported by the hypothesis of the avoidance of micro-embolization and plugging of platelet-rich emboli through the distal coronary circulation, a phenomenon that is more frequent with coronary stent implantation. More recently, smaller but consistent series have demonstrated that its use prior to the performance of primary PTCA can promote the lysis of the occlusive thrombus that triggers AMI occurrence<sup>14-19</sup>. However, we believe that the vast majority of primary PTCA patients from the CENIC Brazilian registry received abciximab as adjunct pharmacology, after arriving in the catheterization laboratory, and a minority as a preamble to the PCI procedure. The database sheet did not specify these different scenarios of abciximab use.

The reinfarction rate ( $\leq 1.5\%$ ) and the need for an AMI patient to undergo urgent coronary bypass surgery ( $<0.2\%$ ) were significantly reduced through this 4-year analysis. However, the mortality rate was not significantly modified, even in the comparison made year by year. This fact may be due to the variations observed in the patients' profiles, with a higher incidence of older and diabetic patients, but balanced with the decrease in patients with previous bypass surgery and with moderate to severe left ventricular contractile dysfunction. Despite a significantly higher success rate obtained with coronary stent implantation and abciximab use, the mortality rate remains nearly unchanged. We believe that these new strategies had contributed to obtaining optimal angiographic results, with less residual vessel diameter stenosis, reducing also the reinfarction rate, and later, the restenosis rate. These results are in accordance with those of the previous large randomized series that compared PCI in AMI, with or without stenting or abciximab, that did not find a significant reduction in the mortality rates with these new percutaneous and pharmacological strategies<sup>13-17</sup>.

Coronary stent implantation in AMI has a more robust indication supported by previous randomized series that compared it with balloon PTCA<sup>13,14</sup>. The daily practice of the Brazilian invasive cardiology centers proves this. On the other hand, the routine use of abciximab still does not have a common sense indication for patients who undergo primary PCI during AMI. The results of a randomized French study<sup>17</sup> support its routine use, due to the recovery of left ventricular function and a lower stent reocclusion rate. However, in this study, abciximab was administered in a heterogeneous manner. From the 150 patients included in the IIb/IIIa arm, 25% received the initial bolus of the drug before arriving in the catheterization laboratory. These patients were the only ones that experienced significant benefits regarding higher AMI vessel patency and recovery of left ventricular function. The definite indication of the abciximab administration for patients who undergo PCI during AMI still requires caution and further study. In Brazil, these results favor the growing use of IIb/IIIa inhibitors during primary PTCA, however, not in the same volume as that observed with coronary stenting. The final cost analysis of this new pharmacology approach may also require future analysis, until it is definitely indicated in the daily practice of AMI<sup>20</sup>. Nevertheless, we should continue to observe the annual results of the CENIC registry to check the continuously increasing use of abciximab in Brazil and the possible influence of that on acute procedural results.

The multivariate analysis identified the independent predictors for the occurrence of procedural failure of major adverse events. The use of balloon PTCA was a predictor of an unsuccessful procedure, and coronary stenting was an independent predictor of reduced reinfarction and in-hospital death rates. However, stent implantation was not a predictor that could prevent the need for urgent bypass surgery. Emergency coronary bypass surgery is becoming increasingly rare, and its indication rests more in the

findings of major adverse anatomical characteristics, such as the presence of a significant left main disease and severe left ventricular contractile dysfunction, angiographic variables that coronary stenting cannot modify<sup>21,22</sup>. The only variable responsible for indicating urgent bypass surgery after PCI in AMI was the presence of moderate to severe left ventricular contractile dysfunction.

Regarding the reduction in mortality and coronary stenting, a previous publication of the CENIC registry<sup>6</sup> demonstrated that compared with balloon PTCA, stenting reduced in-hospital death significantly when applied in patients admitted with Killip class 3 and 4. However, Killip class 1 and 2 patients had a similar death rate with either balloon PTCA or stenting.

The use of abciximab was not an independent predictor for reducing the failure of the PTCA procedure or the occurrence of any of the major adverse cardiac events. This finding is in accordance with previous published studies<sup>14-17</sup>. In these studies, the significant findings in patients treated with abciximab were observed in secondary endpoints, such as reocclusion reduction, or the need to perform a new urgent PTCA. Only one of those studies demonstrated a significant recovery of left ventricular function in patients randomized to abciximab. However, in the CADILLAC trial<sup>14</sup> with a larger population of PCI in AMI treated with abciximab, either with balloon or stenting, abciximab infusion did not promote a significant increase in TIMI-3 flow rates or reduce in-hospital and 1-year death rates.

Patients who presented with severe left ventricular dysfunction still had a higher risk for the occurrence of acute and long-term events after AMI. The adverse prognosis with increasing age, more female patients, diabetic patients, and the presence of more severe multivessel coronary heart disease were also usual common markers for a higher death rate after AMI occurrence<sup>22</sup>.

Larger nationwide AMI registries have also presented their results, either with the use of fibrinolytics or primary PTCA<sup>7-9</sup>. In the NRMCI registries (1, 2, and 3), a total of 1.5 million AMI patients treated in the United States of America were analyzed<sup>7</sup>. This registry demonstrated a consistent and significant increase in primary PTCA performance compared with that with the use of fibrinolytics, increasing from 5% in 1994 to nearly 10% in the last 2 years. Regarding mortality, the registry clarifies the need for experienced operators to perform PCI in AMI to obtain better results. After an initial learning curve, the results got better, with a significant reduction in mortality rates. The in-hospital death rate decreased significantly from 9% to 6%, since 1996 ( $p < 0.05$ ), 2 years after the initial observation of a progressive increase in the use of the procedure. This death rate is similar to that of the CENIC results. However, in the USA registry, fibrinolytic mortality did not undergo a remarkable decrease, ranging from 5% to 6% (NS), which is certainly related to the lack of a relationship between volume of treatment and better results.

In a similar fashion, the German registries MITRA and MIR<sup>8,9</sup> analyzed more than 10,000 patients with AMI, who

underwent the treatment with intravenous streptokinase or primary PTCA from 1994 to 1998. Again, in accordance with the American registry, the learning curve of the mechanical reperfusion technique becomes clear, with a significant reduction in the acute death rate from 13.9% to 6.1% ( $p < 0.05$ )<sup>23</sup>.

The temporal analysis of the Brazilian CENIC registry regarding the use of primary PTCA in AMI patients demonstrated a significant increase in the performance of the method in our country, with a progressively higher success rate, plus a significant reduction in the reinfarction rate and in the need for patients to undergo urgent coronary bypass surgery. The geometric increase in coronary stent implantation and abciximab use were also identified, but despite these new strategies, the mortality rate was not affected during the 4 years. The multivariate analysis identified the independent predictors of procedural failure for the occurrence of major adverse cardiac events. Coronary stenting was a predictor of lower mortality and reinfarction rates. Balloon PTCA was an independent predictor of an unsuccessful PCI procedure.

## Appendix

We express our gratitude to all the members of the Brazilian Society of Interventional Cardiology, who regurlarly sent their data to CENIC (N=215). This analysis would not have been possible without their continuous support. The following Brazilian interventional cardiologists contributed to this registry in the following period, 1996 to 2000. Data originated from 185 different invasive cardiology centers:

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