Percutaneous Stent Implantation for Treating Multivessel Coronary Disease in Patients with and without Involvement of the Proximal Segment of the Anterior Descending Coronary Artery

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Objective - *To assess coronary stent placement in patients with multivessel coronary disease and involvement of the proximal portion of the anterior descending coronary artery.*

Methods - *We retrospectively analyzed the in-hospital and late evolution of 189 patients with multivessel coronary disease, who underwent percutaneous coronary stent placement. These patients were divided into 2 groups as follows: group I (GI) - 59 patients with involvement of the proximal segment of the anterior descending coronary artery; and group II (GII) - 130 patients without involvement of the proximal segment of the anterior descending coronary artery.*

Results - *No significant difference was observed in the success rate of the procedure (91.5% versus 97.6%, p=0.86), nor in the occurrence of major adverse cardiac events (5.1% versus 1.5%, p=0.38), nor in the occurrence of major vascular complications (1.7% versus 0%, p=0.69) in the in-hospital phase. In the late follow-up, the incidence of major adverse cardiac events (15.4% versus 13.7%, p=0.73) and the need for new revascularization (13.5% versus 10.3%, p=0.71) were similar for both groups.*

Conclusion - *The in-hospital and late evolution of patients with multivessel coronary disease with and without involvement of the proximal segment of the anterior descending coronary artery treated with coronary stent placement did not differ. This suggests that this revascularization method is an effective procedure and a valuable option for treating these types of patients.*

Key words: multivessel coronary disease, stent, anterior descending coronary artery

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Patients with multivessel coronary disease who have lesion in the proximal segment of the anterior descending coronary artery have a shorter event-free survival when treated with balloon catheter coronary angioplasty as compared with those who do not have lesion in that arterial segment [1,2]. This fact limited the use of that technique, and the surgical procedure became the preferential option for treating that type of patient[3].

Stents, however, are currently used in more than 70% of the percutaneous coronary procedures and have been shown to provide a great number of benefits, such as the possibility of treating more complex lesions, the control of the complications of coronary dilation, a better clinical evolution, and a significant reduction in restenosis[4,5]. In addition, a substudy of the Stent Restenosis Study[6], which randomized patients with single-vessel coronary disease for balloon catheter coronary angioplasty or stent placement, showed that the most benefited subgroup in regard to restenosis comprised patients with lesion in the anterior descending coronary artery treated with stents.

However, it has not yet been clarified whether in patients with multivessel coronary disease, stent placement may provide similar results in the groups with and without obstruction of the proximal segment of the anterior descending coronary artery. Therefore, in our study, we compared the in-hospital results and the clinical evolution of the patients who had undergone stent implantation.

Methods

We carried out a retrospective observational study of the patients who had undergone percutaneous coronary intervention in 2 or more epicardial vessels from July 1997 to December 2000 at the Hospital Beneficência Portuguesa of São Paulo.

This population comprised patients with clinical fin-

dings of stable or unstable angina or documented myocardial ischemia, or both. Patients with findings of acute myocardial infarction lasting less than 24 hours were excluded, as were those with contraindication for platelet antiaggregating therapy.

Exertional angina was classified according to the criteria of the Canadian Society of Cardiology[7], and unstable angina was classified according to the Braunwald classification [8].

Acute myocardial infarction was defined as an increase in the CKMB isoenzyme greater than 3 times the normal value, or the appearance of new Q waves, or both, in 2 or more contiguous electrocardiographic leads[9].

The vascular complications were classified as follows: a) major – bleeding (puncture sites, and gastrointestinal or genitourinary systems) with a reduction in hemoglobin levels > 5 g/L, or when surgical repair of the artery used for an access route was required, or both; b) minor – bleeding with a reduction in hemoglobin levels > 3 g/L and < 5 g/L.

Patients were divided into 2 groups as follows: group 1 - patients with 1 of the lesions treated with stent placement located in the proximal segment of the anterior descending coronary artery; and group II – patients without involvement of the proximal segment of that artery.

Clinical follow-up was performed with medical visits or telephone calls.

Clinically significant coronary lesion was established as stenosis >70%, which was assessed through quantitative digital angiography. We selected patients with this degree of obstruction in at least 2 of the major epicardial vessels or in their branches with diameters > 2.5 mm.

We defined as the proximal portion of the anterior descending coronary artery its initial segment as far as the emergence of the first septal branch.

The complexity of the lesions was classified as A, B_1, B_2, and C types according to the criterion of the American Heart Association and American College of Cardiology[10], which was modified by Ellis et al[11]. The success of the procedure was defined as a residual lesion < 20% and a normal arterial flow (TIMI III) [12] in the absence of major cardiac complications (death, acute myocardial infarction, and need for emergency surgical revascularization).

Implantation technique and adjunct pharmacotherapy - Patients were prescribed 200 mg/day of aspirin for an undetermined time and 250 mg of ticlopidine twice a day for 30 days, both orally, which should be started, if possible, 3 days prior to the intervention. At the beginning of the procedure 10,000U of intravenous heparin were administered.

The preferred access route was the femoral via, according to our service's practice. After passing a 0.014" extra-support guidewire, predilation of the lesions with the balloon catheter was performed. The stents were implanted in an attempt to achieve a 1.1-1.2 ratio between the diameter of the balloon and that of the artery. The mean final inflation pressure was 12 atmospheres.

Heparin administration after the procedure was indicated only for the patients whose images suggested intracoronary thrombus and for those who had received 3 or more stents.

Once the procedure was finished, the arterial introducers were removed when the activated clotting time was below 150 seconds.

The use of GP IIb/IIIa inhibitors was up to the surgeon in charge.

The primary objective of the study was to assess the incidence of major adverse cardiac events, such as death of any cause, nonfatal acute myocardial infarction, and the need for new revascularization during the clinical follow-up. The secondary objectives were to determine the success rate of the procedure, the in-hospital evolution, and the recurrence of angina during clinical follow-up.

The continuous variables were expressed as mean and standard deviation and were compared using the Student *t* test. The categorical variables were expressed as percentages and the groups were compared using the chi-square and the Fisher tests. A p value < 0.05 was considered statistically significant.

Results

Of the 1,235 patients who underwent stent placement in our service from July 1997 to December 2000, we selected 189 patients with a mean age of 62.47±11.8 years, who met the inclusion criteria of the study. Of these 189 selected patients, 59 (31.2%) comprised group I (GI) and 130 (68.8%) comprised group II (GII).

Patients did not differ in regard to clinical and angiographic characteristics, except for age, which was higher in GI, 65.9±12.7 versus 62±11.8 years (p=0.046), as shown in table I. Unstable angina was the most frequent form of clinical presentation, and 11.9% of GI patients and 5.4% of GII patients (p=0.25) had undergone previous percutaneous intervention.

In regard to angiographic data, patients with 2-vessel coronary artery disease and good ventricular function predominated. The complexity of the lesions was similar in both groups. The average number of stents placed was higher in

Table I - Clinical characteristics

	Total	Group I	Group II	*P*
Total	189 (100%)	59 (31.2%)	130 (68.8%)	-
Age (years)†	62.47±11.77	65.88±12.68	62±11.8	0.046
Male sex	131 (19.3%)	38 (64.4%)	93 (71.5%)	0.765
Clinical findings				
Asymptomatic	35 (18.5%)	10 (16.9%)	25 (19.2%)	0.911
Stable angina	69 (36.5%)	21 (35.6%)	48 (36.9%)	0.975
Unstable angina	75 (39.7%)	24 (40.7%)	51 (39.2%)	0.981
AMI > 24 h	10 (5.3%)	4 (6.8%)	6 (4.6%)	0.816
Diabetes mellitus	39 (20.6%)	15 (25.4%)	24 (18.5%)	0.489
Smoking	51 (27%)	15 (29.4%)	36 (27.7%)	0.939
Dyslipidemia	102 (54%)	27 (45.8%)	75 (57.7%)	0.476
Arterial hypertension	141 (74.6%)	44 (74.6%)	97 (74.6%)	0.906
Previous AMI	53 (28%)	14 (23.7%)	39 (30%)	0.614
Previous MR	0	0	0	-
Previous PCI	14 (7.4%)	7 (11.9%)	7 (5.4%)	0.249

AMI - acute myocardial infarction; MR - surgery of myocardial revascularization; PCI - percutaneous coronary intervention; † mean ± standard deviation.

GII [1.79 versus 1.5, (p=0.001)]. GP IIb/IIIa inhibitors were used in 15.3% of the cases (tab. II).

The success rates of the procedure were 91.5% and 97.6% (p=0.86) for GI and GII, respectively, and the incidences of major adverse cardiac complications were 5.1% and 1.5% (p=0.38) for GI and GII, respectively. One 82-year-old patient in GI (1.7%) died from renal failure and diabetes mellitus, due to aggravation of renal function, despite the previous protective measures. No patient required emergency myocardial revascularization in any of the groups.

The incidence of major vascular complications was low, 1.7%, corresponding to only 1 GI patient. The results of the in-hospital phase are shown in table III.

Of the eligible patients, 52 (94.5%) GI patients and 116 (90%) GII patients (p=0.92) were followed up for a mean period of 275±250 days and 186±153 days for groups GI and GII, respectively (p=0.004).

In regard to the incidence of death, no significant difference was observed between the groups: 1.9% (GI) and 3.4% (GII) (p=0.98). No nonfatal acute myocardial infarction occurred. The need for new myocardial revascularization was also similar in both groups, 13.5% (GI) and 10.3% (GII) (p=0.71).

The rate of major adverse cardiac events, which was the primary objective of this study, was 15.4% and 13.7% for groups GI and GII, respectively (p=0.73).

Finally, 7.7% of GI patients and 12.9% of GII patients (p=0.53) had recurrence of angina pectoris. The results of the clinical follow-up are shown in table IV.

Table III - Results: in-hospital phase

	Total	Group I	Group II	*p*
Success	181(95.7%)	54(91.5%)	127 (97.6%)	0.86
Success	8 (4.3%)	5 (8.5%)	3 (2.4%)	0.143
MACE	5 (2.6%)	3 (5.1%)	2 (1.5%)	0.381
Death	1 (0.5%)	1 (1.7%)	0	0.691
QAMI	1 (0.5%)	1 (1.7%)	0	0.695
NQAMI	3 (1.6%)	1 (1.7%)	2 (1.5%)	0.583
Emergency MR	0	0	0	-
Surgical	0	0	0	-
Percutaneous	0	0	0	-
Vascular complications	5 (2.6%)	3 (5.1%)	2 (1.5%)	0.381
Minor	4 (2.1%)	2 (3.4%)	2 (1.5%)	0.789
Major	1 (0.5%)	1 (1.7%)	0	0.691
ARF	4 (2.1%)	1 (1.7%)	3 (2.3%)	0.779
Stroke	2 (1.1%)	1 (1.7%)	1 (0.8%)	0.844

MACE- major adverse cardiac event; QAMI - Q-wave acute myocardial infarction; NQAMI - non-Q-wave acute myocardial infarction; ARF - acute renal failure; MR - myocardial revascularization.

Discussion

The anterior descending coronary artery accounts for 40% to 50% of the irrigation of the left ventricular myocardium. Therefore, a severe obstructive lesion involving its proximal portion is an important predictor of morbidity and mortality [13,14]. In these cases, invasive treatment is usually indicated, particularly when a large myocardial area is under a higher risk [15-17].

Coronary angioplasty and surgical myocardial revascularization have been indicated for the treatment of multivessel coronary disease with or without involvement of the anterior descending coronary artery [18]. A substudy of the Coronary Angioplasty versus Bypass Revascularization Investigation (CABRI) randomized 1,054 patients with coronary disease in 2 or more epicardial coronary vessels for surgical treatment or balloon catheter coronary angioplasty. That study, however, showed that, compared with other segments, the proximal 1/3 of the anterior descending coronary artery had the highest risk of developing restenosis after percutaneous intervention. This suggested that the presence of a proximal lesion in that artery should influence the choice of the revascularization strategy, when the surgical approach would be the most indicated. However, that study did not routinely use coronary stents, which would have decreased the restenosis rate and the need for new revascularization [4,5,19].

Versaci et al [20] carried out a randomized study of patients with single-vessel disease with proximal lesion of the anterior descending coronary artery treated with balloon catheter coronary angioplasty or stent placement. Those authors reported a greater event-free survival in the latter group, 70% versus 87% (p=0.04), and a lower rate of restenosis, 40% versus 19% (p=0.02), after a 1-year evolution.

The great advantage of the use of stents in the proximal 1/3 of the anterior descending coronary artery is based on the fact that balloon catheter coronary angioplasty at that site has late luminal loss twice as high as that found in other arterial segments [5,21,22].

Based on these data, we tried to assess whether the involvement of the proximal segment of the anterior descending coronary artery would continue to influence the evolution of patients with multivessel coronary disease treated with coronary stent implantation.

In-hospital evolution was similar in both groups, and a high success rate was observed for the procedure, 91.5% for GI and 97.6% for GII (p=0.86). It is worth noting that only 1 patient (1.7%) in GI had Q-wave acute myocardial infarc-

Table II - Angiographic characteristics

	Total	Group I	Group II	*p*
Number of patients	189 (100%)	59 (31.2%)	130 (68.8%)	-
Lesions treated	411 (100%)	136 (33.1%)	275 (66.9%)	-
Stents implanted	292 (100%)	94 (32.2%)	198 (67.8%)	-
Lesions/patient†	2.83±0.37	2.2±0.42	2.15±0.35	0.394
Stents/patient†	1.6±0.55	1.5±0.55	1.79±0.54	0.0001
Ejection fraction†	72.7±14.9	75.2±14.4	71.7±15.1	0.136
2-vessel	157 (83.1)	46 (78%)	111 (85.4%)	0.788
3-vessel	32 (16.9%)	13 (22%)	19 (14.6%)	0.397
Types of lesions				
B_2	105 (25.5%)	23 (16.9%)	82 (29.8%)	0.116
C	89 (21.7%)	25 (18.4%)	64 (23.3%)	0.697
Use of GP IIb/IIIa inhibitor	29 (15.3%)	11 (18.6%)	18 (13.8%)	0.612

† mean ± standard deviation.

Table IV - Results: late evolution

	Total	Group I	Group II	*p*
Total of eligible patients	181 (100%)	54 (31.2%)	127 (68.8%)	-
Total of patients followed up	168 (92.8%)	52 (96.2%)	116 (91.3%)	0.952
Mean time (days)†	200±199	275±250	186±153	0.004
Clinical findings				
Asymptomatic	143 (85.1%)	45 (86.5%)	98 (84.5%)	0.852
Recurring angina	19 (11.3%)	4 (7.7%)	15 (12.9%)	0.53
Stable angina	14 (8.3%)	3 (5.8%)	11 (9.5%)	0.714
Unstable angina	5 (3%)	1 (1.9%)	4 (3.4%)	0.985
MACE	24 (14,3%)	8 (15.4%)	16 (12.9%)	0.736
Death	5 (3%)	1 (1.9%)	4 (3.4%)	0.985
AMI	0	0	0	-
Revascularization	19 (11.3%)	7 (13.5%)	12 (10.3%)	0.715
Death				
Cardiac	0	0	0	-
Noncardiac	5 (3%)	1 (1.9%)	4 (3.4%)	0.985
Revascularization				
Percutaneous	13 (7.7%)	6 (11.5%)	7 (6%)	0.36
Surgical	6 (3.6%)	1 (1.9%)	5 (4.3%)	0.807

† mean ± standard deviation.

tion, but no emergency surgery was required. In reality, as stents control severe coronary dissection, which is the most common cause of acute occlusion after balloon catheter coronary angioplasty, they significantly reduce the need for emergency surgery.

These early results are in accordance with those of other authors who used stent implantation to treat multivessel coronary disease, except for the incidence of non-Q-wave acute myocardial infarction, which was lower in our study (1.7% in GI and 1.5% in GII) as compared with the incidence in the series of other authors, which ranged from 6% to 18% [23-26]. A probable explanation for this fact is that those authors included patients with lesions located in saphenous vein bypasses and used rotational and directional atherectomy as an adjunct device; these strategies relate to a higher rate of early complications [27-32].

Major and minor vascular complications also did not differ in either group.

Clinical follow-up data showed that 86.5% of GI patients and 84.5% of GII patients were asymptomatic (p=0.85). Mathew et al [25] in their series of patients with multivessel coronary disease treated with stents also reported excellent control of symptoms because 79% of their patients had no severe angina (CCS III and IV) by the end of 1 year.

The occurrence of major adverse cardiac events, which was the primary objective of our study, was 15.4% in GI and 13.7% in GII (p=0.73), showing a similar and favorable evolution in both groups.

No acute myocardial infarction was observed in this period, a fact that was also reported by Kornowski et al [23] in their series.

It is worth emphasizing that the need for new myocardial revascularization was 13.5% in GI and 10.3% in GII (p=0.71) in our study. This need was lower than that observed in the randomized studies using conventional balloon catheter coronary angioplasty or surgery for treating multivessel coronary disease, where that need ranged from 30% to 48% in the percutaneous group [33].

The analysis of our data suggests that percutaneous treatment using coronary stents in a patient with multivessel coronary artery disease may be safely performed and provides good clinical follow-up results. The involvement of the proximal portion of the anterior descending coronary artery treated with stent implantation did not prove to be a factor of worse prognosis in the clinical evolution, despite the fact that GI had the highest mean age (p=0.046), the longest follow-up (p=0.004), and the lowest mean number of stents implanted (p=0.001).

Finally, the late results of the ARTS and SoS trials 34,35 are important and have been anxiously awaited. Those trials randomized patients with multivessel coronary disease for surgery or percutaneous treatment with stents, and the analysis of the subgroups will probably provide further information about the importance of the proximal lesion of the anterior descending coronary artery in patients with multivessel coronary disease.

In conclusion, ours was a retrospective study that included a heterogeneous population with a relatively small number of patients. Among the basic clinical characteristics, we observed a difference in age, a longer follow-up, and a lower mean number of stents implanted in group I, facts that would not favor the patients who had lesion in the anterior descending coronary artery. A large variety of stent designs was used. Most patients treated had 2-vessel coronary disease and good ejection fraction, and the results here found may not occur in a population in which 3-vessel coronary artery disease and significant ventricular dysfunction predominate.

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