Coronary Stent Implantation in Diabetic versus Nondiabetic Patients. Early and Late Outcomes

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Objective – *To assess whether coronary stenting in diabetic patients provides in-hospital results and clinical evolution similar to those in nondiabetic patients.*

Methods – *From July '97 to April '99 we performed coronary stent implantation in 386 patients with coronary heart disease, who were divided into two groups: diabetic patients and nondiabetic patients. The in-hospital results and the clinical evolution of each group were retrospectively analyzed.*

Results – *The nondiabetic group comprised 305 (79%) patients and the diabetic group 81 (21%) patients. Basic clinical and angiographic characteristics were similar. Angiographic success was in diabetics = 96.6% vs in nondiabetics = 97.9% (p=ns). Among the major complications in the in-hospital phase, the rate of myocardial infarction was higher in the diabetic group (7.4% vs 1.9%) (p=0.022). In the follow-up, a favorable and homogeneous evolution occurred in regard to asymptomatic patients, myocardial infarction, and death in the groups. A greater need for revascularization, however, existed in the diabetic patients (15% vs 2.4%, p<0.001).*

Conclusion – *Coronary stenting in diabetic patients is an efficient procedure, with a high angiographic and clinical success rate similar to that in nondiabetic patients. Diabetic patients, however, had a higher incidence of in-hospital myocardial infarction and a greater need for additional myocardial revascularization.*

Keywords: diabetes mellitus, coronary artery disease, coronary stent

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Diabetes mellitus and atherosclerosis have a reciprocal relation as diabetes is one of the major risk factors for the development of atherosclerosis, which is the major cause of mortality in this group of patients.

Studies based on pathological and angiographic evidence [1,2] show a higher severity and extension of the coronary atherosclerotic disease in diabetic patients with a consequent unfavorable clinical evolution in the long-term.

Controversies in regard to the best strategy for myocardial revascularization in diabetic patients still occur. Percutaneous intervention through balloon catheter angioplasty has some disadvantages such as a smaller capacity for complete revascularization due to the unfavorable angiographic profile and the high incidence of restenosis resulting in high morbidity and late mortality [3-5].

In this context, coronary stenting is a useful therapeutical option because it not only reduces the incidence of restenosis and allows a more complete revascularization, but also facilitates the approach of more complex lesions with greater safety and a lower rate of complications [6,7].

Our study aims to assess in-hospital results and the late clinical outcome of diabetic and nondiabetic patients undergoing coronary stenting.

Methods

In our service at the Hospital da Beneficência Portuguesa de São Paulo, 430 stents were implanted in 386 patients from July '97 to April '99. The nondiabetic group comprised 305 (79%) patients who received 340 stents, and the diabetic group comprised 81 (21%) patients, 12 (14.8%) of whom were insulin-dependent patients, receiving 90 stents. The mean age was 61 years, and males prevailed in both groups (Table I).

We included patients who underwent stent implantation, with of stable or unstable angina, and acute myocardial infarction. The groups were homogeneous in regard

to demographic and basic clinical characteristics (Table I). In both groups, the prevailing clinical status was unstable angina, and in the nondiabetic group asymptomatic patients predominated (Table I).

Three days prior to the procedure, when clinically possible, the patients received 500mg/day of ticlopidine and 200mg/day of acetylsalicylic acid for 30 days and during the entire period of follow-up, respectively. In the catheterization laboratory, after selective catheterization of the coronary artery, 10,000 U of heparin were administered into the coronary artery.

Stents were implanted after conventional balloon catheter angioplasty of the target lesion, using final pressures routinely ≥10 atmospheres.

Angiographic success was defined as residual lesion <20% in the presence of TIMI III flow, and the clinical success was defined as the angiographic success in the absence of major complications (acute myocardial infarction, need for emergency myocardial revascularization, and death). Major vascular complications were defined as those complications requiring surgical repair at the site of puncture or bleeding with a hemoglobin level fall >5g/dL.

The percentage stenosis and the minimum and reference luminal diameters of the artery were analyzed before and immediately after the procedure through quantitative digital angiography, using the online system Toshiba DEF 1000A.

Clinical follow-up was performed through out patient visits, direct telephone contact with the patient, or with the assistant physician.

Continuous variables were expressed as mean and standard deviation and assessed using the paired and nonpaired Student *t* tests. Categorical variables presented as percentages were analyzed through the chi-square test. A p value <0.05 was considered significant.

Results

Angiographic and clinical successes were similar: 96.6% and 97.9%, respectively, for the diabetic group, and 92.6% and 96.4%, respectively, for the nondiabetic group (p=ns).

Angiographic characteristics were similar in regard to the artery treated, complexity, and length of the lesions (Table II). A quantitative digital analysis showed no differences, except in the minimum luminal diameter after the procedure, which tended to be smaller in the diabetic group (Table III).

During the in-hospital evolution, the diabetic group showed a higher rate of acute myocardial infarction 7.4% vs 1.9% (p=0.022), (fig. 1) in spite of having a similar incidence of Q and non-Q acute myocardial infarctions when separately analyzed (Table IV). No emergency myocardial revascularization was required, and 2 (0.6%) patients in the nondiabetic group died due to subacute thrombosis of the stent. Major vascular complications were also similar in both groups (Table IV).

In the diabetic group, the mean clinical follow-up was 10.8±6.12 months, and it was performed in 73 (90%) patients. In the nondiabetic group, the mean clinical follow-up was 11.08±6.31 months (p=ns), and it was performed in 287 (94%) patients. No difference was observed in the incidence of asymptomatic patients (90.4% vs 93%) or in the inci-

Table I - Demographic and clinical data

	DM (n = 81)	NDM (n = 305)	P
Age	61.8±11.3	61.3±12.4	NS
Sex	54 (67%)	222 (73%)	NS
Hypertension	59 (73%)	192 (63%)	NS
Dyslipidemia	45 (56%)	137 (45%)	NS
Smoking	13 (16%)	91 (30%)	0,07
Familial history	37 (46%)	168 (55%)	NS
Previous TCA	11 (14%)	6 (12%)	NS
Previous AMI	16 (20%)	88 (29%)	NS
Previous surgery	14 (18%)	55 (18%)	NS
Unstable angina	54%	48%	NS
Stable angina	26%	21%	NS
Asymptomatic	13%	20%	0,088
AMI	07%	11%	NS

DM- diabetes mellitus; NDM- nondiabetic; TCA- transluminal coronary angioplasty; AMI – acute myocardial infarction.

Table II – Angiographic characteristics

Vessel treated	DM (n=90)	NDM (n=340)	p
AD	38%	37%	NS
RC	33%	31%	NS
NS	10%	11%	NS
SVBG	14%	15%	NS
Type of lesion			
A	04%	04%	NS
B1	29%	24%	NS
B2	38%	34%	NS
C	29%	32%	NS
Length			
< 10 mm	21%	24%	NS
between 10 e 20 mm	47%	53%	NS
> 20 mm	32%	24%	NS

DM- diabetes mellitus; NDM- nondiabetic; LAD – left anterior descending coronary artery; RC – right coronary artery; Cx- circumflex coronary artery; SVBG- saphenous vein bypass graft.

Table III – Data from quantitative digital angiography

	DM (n = 90)	NDM (n = 340)	P
Pre RLD (mm)	3.09±0.42	3.15±0.54	NS
Pre MLD (mm)	0.80±0.48	0.88±1.64	NS
Post MLD (mm)	3.20±0.39	3.29±0.30	0.064
% stenose pre	89.3±8.87	88.4±10.7	NS
% stenose pos	1.30±8.37	2.03±10.7	NS

DM- diabetes mellitus; NDM- nondiabetic; RLD- reference luminal diameter; MLD– minimum luminal diameter; "pre" refers to prior to the procedure; "post" refers to after the procedure

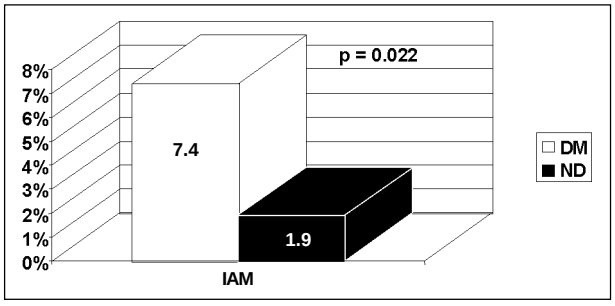

Fig.1 – In-hospital results.

Table IV - Incidence of in-hospital complications

	DM (n=81)	NDM (n=305)	P
Any AMI	7,4%	1,9%	0.022
Q AMI	2,5%	0,6%	NS
Non-Q AMI	4,9%	1,3%	NS
Emergency MR	0	0	
Death	0	0,6%	NS
Vascular complications	6,1%	7,8%	NS

DM- diabetes mellitus; NDM- nondiabetic; AMI- acute myocardial infarction; MR- myocardial revascularization.

dence of patients with stable angina (6.8% vs 5.0%) and unstable angina (2.7% vs 1.3%) between the diabetic and nondiabetic groups, respectively. Rates of acute myocardial infarction and death were also similar; the diabetic group, however, required more myocardial revascularization (15% vs 2.4%) (p<0.001). This directly influenced the occurrence of major cardiac events in the diabetic group (p<0.0001) (fig. 2).

Discussion

The presence of diabetes mellitus in patients with coronary atherosclerotic disease is a marker of poor prognosis, representing a challenge to clinicians, intervention cardiologists, and cardiac surgeons.

The metabolic and endothelial changes present in diabetic patients and the higher chance of rupture of the plaque, thrombus formation, and exacerbation of the intimal hyperplasia are determinant factors of a higher incidence of complications and restenosis in these patients when they

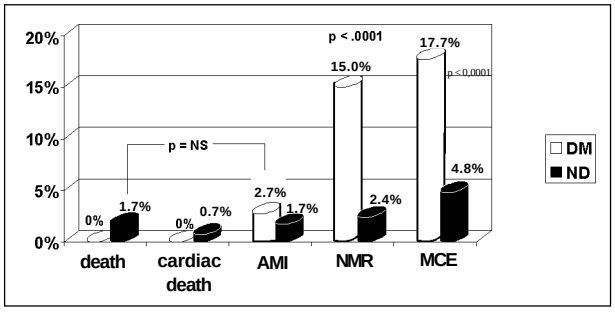

Fig. 2 – NMR – need for myocardial revascularization; MCE – major cardiac events.

undergo percutaneous coronary interventions [4,8,9-11]. In addition, diabetic patients have more severe angiographic and clinical profiles and usually have associated diseases, such as hypertension, dyslipidemia, coagulopathies, and nephropathies, therefore requiring a strict control because these factors influence the occurrence of cardiovascular events during follow-up [12,13].

Randomized studies, such as BARI [14] and CABRI [15], in patients with multivessel lesions have shown a higher survival rate for diabetic patients undergoing surgery, as compared with those treated with coronary balloon angioplasty. The EAST study [16], however, has shown no difference in patient survival at the end of 5 years for both procedures.

Another study [17] recently published analyzing patients who met the criteria for randomization but who did not take part in the BARI Study has shown a similar mortality rate for diabetic patients undergoing balloon catheter angioplasty and surgery. Some distinct basic and angiographic characteristics were observed in the diabetic control group when compared with the randomized group, as follows: higher degree of education, better quality of life, lower incidence of smoking, and lower degree of left ventricular dysfunction. They also reported that in the control group, the diabetic patients undergoing balloon catheter angioplasty had a lower incidence of triple vessel coronary atherosclerotic disease when compared with the group undergoing surgery.

The role played by coronary stents in the treatment of diabetic patients has not been totally established. In our study, where we report our experience with coronary stenting, we observed a high rate of clinical and angiographic success for both groups. In the in-hospital phase, however, the incidence of major cardiac events was higher in the diabetic group, basically due to a higher incidence of acute myocardial infarction in this group. This may be explained by the higher predisposition to rupture of the atheromatous plaque in these patients with consequent formation of a platelet thrombus, in addition to changes in the coagulation system [1,2,3,7,8,13]. It is worth stressing that emergency myocardial revascularization was not required for any group, showing the efficiency of stenting in this context.

Clinical follow-up showed a favorable evolution because more than 90% of the patients of both groups were asymptomatic. The same occurred with the incidence of acute myocardial infarction and late deaths, but more myocardial revascularizations were required in the diabetic group. Studies by Tilli et al [18], Kastrati et al [19], and Abizaid et al [20] have shown a need two times greater for revascularization of the target lesion (RTL) by the end of 6 months in diabetic patients undergoing stenting. Its employment, however, shows a clear superiority in relation to the primary success, clinical evolution, and rate of restenosis, as compared with conventional balloon catheter angioplasty [21-23].

More recently, the use of adjunctive pharmacological therapy, mainly inhibitors of the receptors of platelet glycoprotein IIb/IIIa, has shown additional benefit in the percutaneous treatment of diabetic patients, as shown in the EPIS-

TENT Study [24]. In this study, administration of abciximab associated with coronary stenting caused a 50% reduction in the need for RTL in that group of patients by the end of 6 months, and this benefit remained after one year, evolving in a manner similar to that of nondiabetic patients.

We believe, as reported by Centemero et al [25], that the mere presence of diabetes mellitus should not determine the type of revascularization (percutaneous or surgical). Other factors should be considered as follows: presence of associated comorbidities; type of clinical presentation of the diabetes; patient's age; morphological and angiographic characteristics of the lesions; extension of the coronary atherosclerotic disease; presence of ventricular dysfunction; and the social, economical, and cultural level of the patient.

Finally, we should await the conclusion of randomized studies (ARTS, SOS), which including the analysis of subgroups, such as diabetic patients, will provide important information about the efficacy of stent implantation versus surgery in patients with multivessel lesions.

The recent ARTS Study [26] comparing the efficacy of stenting versus surgery in patients with multivessel lesions has shown a higher incidence of patients free from compound events (death, myocardial infarction, surgery, or re-PTCA) in the surgical group by the end of one year (87.8% vs 73.7%; $p<0.001$). This difference basically results from a greater need for a new angioplasty in the group undergoing the percutaneous procedure. Analysis of the diabetic subgroup, however, has shown that a greater difference favoring the surgical group exists (82.3% vs 60.7%, $p<0.001$) and that the isolated use of stents in diabetic patients with multivessel lesions is not enough to optimize the results. The ARTS Study has also stressed the importance of the adjunctive pharmacological therapy with inhibitors of PG IIb/IIIa in the percutaneous approach of these patients.

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