Previous Restenosis As a Prognostic Indicator in New Conventional Stent Implantation at a Different Location

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Introduction and objectives. The aim was to determine whether data on restenosis of a previous stent are useful for predicting outcome in patients who need to undergo a second conventional stent implantation at a different location because of coronary disease progression.

Methods. The study included 80 patients who, during 2000-2004, underwent a second conventional (ie, not drug-eluting) stent implantation for de novo lesions at a different location to that of the previous stent. Major adverse cardiac events (MACE) were defined as death, non-fatal myocardial infarction, or the need for target lesion revascularization (TLR).

Results. One year after the second procedure, the cumulative incidence of MACE was significantly higher in patients who experienced significant restenosis of the previous stent than in those who did not (40.6% vs 12.5%, *P*=.004). Univariate predictors of MACE were: evidence of previous stent restenosis, previous myocardial infarction, and a small vessel (≤2.75 mm). However, the only independent predictor (Cox regression) of a MACE was previous stent restenosis (hazard ratio 3.85, 95% confidence interval, 1.46-10.18; *P*=.007). At 1 year, the TLR rate was also higher in patients with previous stent restenosis (31.3% vs 8.3%; *P*=.008), in those with small vessels, and in diabetics. Previous stent restenosis and a small vessel were independent predictors of TLR.

Conclusions. Restenosis of a previous stent is a strong predictor of major adverse events in patients undergoing a second conventional stent implantation at a different location because of coronary disease progression.

Key words: *Coronary angioplasty. Stent. Restenosis. Coronary disease progression. Prognosis.*

El comportamiento reestenótico previo como predictor pronóstico ante nueva implantación de stent convencional en distinta localización

Introducción y objetivos. Averiguar si, en pacientes que requieren un segundo procedimiento de implante de *stent* convencional en una nueva localización por progresión de enfermedad coronaria, la información aportada por la respuesta reestenótica frente al *stent* previo es útil para predecir la evolución.

Métodos. Se incluye a los 80 pacientes que recibieron un segundo procedimiento de implante de *stent* convencional (no farmacoactivo) sobre lesiones de novo de distinta localización de la del *stent* previo en el período 2000-2004. Se definió como evento mayor la ocurrencia de muerte, infarto no mortal o necesidad de revascularización de la lesión diana de novo (RLD).

Resultados. Al año del segundo procedimiento, los pacientes que habían evidenciado reestenosis significativa del *stent* del procedimiento previo tuvieron una incidencia de eventos mayores superior a los pacientes sin reestenosis previa (el 40,6 frente al 12,5%; p = 0,004). Los predictores univariables de eventos mayores fueron la evidencia de reestenosis previa, el infarto previo, y el vaso pequeño (≤ 2,75 mm), aunque el único predictor independiente de eventos (regresión de Cox) fue la reestenosis previa (*hazard ratio* = 3,85; intervalo de confianza del 95%, 1,46-10,18; p = 0,007). La RLD al año fue también mayor en los pacientes con reestenosis previa (el 31,3 frente al 8,3%; p = 0,008), en vasos pequeños y en diabéticos, siendo predictores independientes los dos primeros.

Conclusiones. El comportamiento reestenótico frente a un *stent* previo es un potente predictor de eventos mayores en pacientes que reciben un segundo procedimiento de implante de *stent* convencional en distinta localización por progresión de su enfermedad coronaria.

Palabras clave: *Angioplastia coronaria.* Stent. *Reestenosis. Progresión de enfermedad coronaria. Pronóstico.*

INTRODUCTION

Most research on follow-up in patients who have undergone intracoronary stent implantation has focused on restenosis within the segment covered by the stent

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ABBREVIATIONS

HR: hazard ratio
PCI: percutaneous coronary intervention
TLR: target lesion revascularization
CS: conventional stent
DES: drug-eluting stent

and the consequent need for revascularization of the restenotic lesion. However, there are few studies on the simultaneous progression of nonsignificant (and thus untreated) atherosclerotic plaque in the coronary tree of these patients, and a more than 20% progression in luminal stenosis versus a baseline of 7%-20% of coronary plaque per year has been reported.[1,2] It is known that the recurrence of angina symptoms 1 year or more after intervention tends to lead to coronary disease progression more than in-stent restenosis.[3,4] We hypothesized that the greater or lower neointimal hyperplastic response induced by the previous stent tends to be repeated in other locations when a new stent is implanted in the same patient, but have not found a specific response to this idea in the scientific literature. Thus, in the present study, our interest focuses on knowing whether, in patients undergoing successive percutaneous revascularization procedures due to coronary disease progression, the information contributed by individual behavior in response to previous stenting can be used to predict the evolution after implanting a new stent in another location.

METHODS

Between 2000-2004, 1207 revascularization procedures were done via percutaneous coronary intervention (PCI) in our unit. All those patients fulfilling the following selection criteria were included and analyzed: they had undergone stent implantation in previous months or years and subsequently needed a new PCI for one or more significant de novo lesions (stenosis >50%) using conventional stents (CS). Patients who had undergone revascularization with a drug-eluting stent (DES) were excluded, as well as those who only presented significant in-stent restenosis (without significant de novo lesions), and those with new lesions appearing in segments close to the stent (5 mm proximal and distal) or previously dilated with balloon, with the aim of not confusing de novo lesions with restenotic lesions. Thus, 80 patients were finally included in the study.

Definitions and Variables Analyzed

Information on clinical follow-up after the second PCI procedure was obtained from planned check-ups at 1, 6, and 12 months post-procedure, medical records, the computer database of the entire population in our hospital area, and by telephone contact with all the patients included (or with family members). Data referring to the interventionist procedures were obtained from the clinical reports and angiographic follow-up, with restenosis defined as angiographic stenosis >50% (binary restenosis) in the segment covered by the stent or in its margins at follow-up.

A major cardiac event was defined as the occurrence of some of the following events during follow-up: cardiac death, non-fatal myocardial infarction, or target lesion revascularization (TLR) via stenting in the second procedure whether through surgery or a new PCI. Sudden death from acute myocardial infarction and heart failure were considered cardiac deaths. Myocardial infarction at follow-up was defined as the occurrence of typical prolonged pain together with the appearance of new Q waves or creatine-kinase MB isoenzyme (CK-MB) levels higher than twice the normal limit. Indications for a new coronary angiography were identified by the clinicians responsible for each patient based on the appearance of angina or criteria for inducible ischemia during follow-up, and the decision to undertake revascularization was taken based on the surgeon's criteria.

Statistical Analysis

Continuous variables are expressed as mean (Standard Deviation) and compared via the Student *t* test, whereas discrete or dichotomous variables are expressed as percentages and compared via χ^2 or the Fisher exact test. Major cardiac event-free survival was analyzed using the Kaplan-Meier method, and the log-rank test used to assess between-group differences in event-free survival. The time up to the first event was taken into account in those patients undergoing two or more events of the composite endpoint.

Univariate analysis was performed to assess the possible association of each of the variables under study with each dependent variable (major events and TLR). Independent predictors of major events and need for TLR were identified using Cox multivariate regression analysis. This included variables that were significant ($P<.05$) in the univariate analysis, as well as diabetes (as a potentially confounding variable), and the backward stepwise method was applied successively with F-enter and F-remove values of 0.05 and 0.10, respectively. The estimated coefficients were expressed as a hazard ratio (HR), with their respective 95% confidence intervals (95% CI). SPSS 11.0 software (Chicago, Illinois) was used and a *P* value less than .05 was considered significant.

RESULTS

Table 1 shows the baseline clinical, angiographic, and PCI-related characteristics of the 80 patients included in

TABLE 1. **Baseline Clinical, Angiographic, and Procedural Characteristics***

	Total (n=80)	Group A (With Previous Restenosis) (n=32)	Group B (Without Previous Restenosis) (n=48)	*P*
Age, mean (SD), years	62.9 (9.9)	64.2 (8.5)	61.9 (10.7)	.32 NS
Female sex	27 (33.8%)	46.9%	25.0%	.04
Diabetes mellitus	34 (42.5%)	59.4%	31.3%	.01
IDDM	15 (18.8%)	25.0%	14.6%	.24 NS
Arterial hypertension	45 (56.3%)	50.0%	60.4%	.36 NS
Hyperlipidemia	55 (68.8%)	68.8%	68.8%	1.00 NS
Smoking habit	25 (31.3%)	25.0%	35.4%	0.32 NS
Previous infarction	29 (36.3%)	43.8%	31.3%	0.26 NS
Previous surgery	4 (5%)	0%	8.3%	0.17 NS
Clinical presentation				
Stable angina	33 (41.3%)	46.9%	37.5%	0.69 NS
STEACS	42 (52.5%)	46.9%	56.3%	
NSTEACS	5 (6.3%)	6.3%	6.3%	
2-3 vessel disease	33 (41.3%)	50.0%	35.4%	0.19 NS
Ejection fraction, mean (SD), %	61.4 (12.0%)	62.1 (12.2%)	60.9 (12.0)	0.67 NS
Location AD	25 (31.3%)	46.9%	20.8%	0.01
Abciximab	11 (13.8%)	12.5%	14.6%	0.79 NS
Complex lesions (B2/C)	37 (46.3%)	46.9%	45.8%	0.93 NS
No. stents/patient, mean (SD)	1.40 (0.67)	1.38 (0.61)	1.42 (0.71)	0.79 NS
No. stents/lesion, mean (SD)	1.14 (0.35)	1.13 (0.32)	1.15 (0.38)	0.80 NS
Stent diameter, mean (SD), mm	2.91 (0.47)	2.82 (0.39)	2.96 (0.51)	0.18 NS
Stent diameter ≤2.75 mm	39 (48.8%)	53.1%	45.8%	0.52 NS
"Total length stented", mean (SD), mm	20.36 (9.53)	18.72 (8.0)	21.46 (10.37)	0.21 NS
"Total length stented" ≥25 mm	17 (21.3%)	21.9%	20.8%	0.91 NS

*AD indicates anterior descending artery; SD, standard deviation; IDDM, insulin-dependent diabetes mellitus; NS, nonsignificant; STEACS, ST-segment elevation acute coronary syndrome; NSTEACS, non-ST- segment elevation acute coronary syndrome.

the study. The period between the previous CS implantation procedure and the current one was 19 (13) months. Significant previous stent restenosis ≥50% (from the first procedure) together with coronary disease progression was found in 32 of the 80 patients (group A); such restenosis was focal in 12 patients and diffuse in the other 20. The 32 patients required revascularization of both the restenotic lesions (20 patients with in-stent CS, and the remainder with balloon) and the de novo lesions during the same procedure. The remaining 48 patients (group B) only presented coronary disease progression, without previous stent restenosis (first procedure), and were treated by implanting a CS in a new location.

Some 94 de novo lesions were treated in the 80 patients, implanting an average of 1.4 stents/patient, with an average stent diameter 2.9 (0.4) mm, total stent length 20 (9) mm (range, 8-61 mm), with 46% being complex lesions (type B2/C). In total, 112 CS were implanted in the 80 patients, located as follows: 26 in the anterior descending artery, 35 in the right coronary, 29 in the circumflex, 2 in the first diagonal branch of the LADC, 1 in the saphenous, and 1 in the left common trunk. The procedure was successful in all patients (<20% residual stenosis with TIMI grade 3 flow), and were prescribed antiplatelet agents with aspirin indefinitely and clopidogrel for at least 1 month.

Clinical Evolution at one Year

Complete information on follow-up in the 80 patients was obtained at 12 months. The incidence of major events in terms of death, non-fatal infarction, or need for TLR at 1 year follow-up was 40.6% (13/32) in the group presenting stent restenosis in a previous location (group A), versus 12.5% (6/48) in the group that did not present previous stent restenosis (group B), with highly significant differences (χ^2=8.38; *P*=.004). Major events at 1-year follow-up are shown in Table 2. Four deaths (all cardiac) occurred in the year following PCI, two in Group A (one due to sudden death and one due to fatal acute infarction), and the other two in group B (one due to sudden death and another due to acute pulmonary edema). Five non-fatal myocardial infarctions occurred in group A, and one in group B, with significant differences (15.6 vs 2.1%; *P*=.03). All five patients underwent coronary angiography and new revascularization procedures, with the exception of one group A patient due to patient refusal, and all presented significant restenosis in the stents from the second procedure, which was accompanied in two

TABLE 2. **Major Events at 1-Year Follow-Up***

	Group A (With Previous Restenosis) (n=32)	Group B (Absence of Previous Restenosis) (n=48)	*P*
Death	2 (6.3%)	2 (4.2%)	0.53 NS
Non-fatal infarction	5 (15.6%)	1 (2.1%)	0.03
Target lesion revascularization†	10 (31.3%)	4 (8.3%)	0.008
Major events	13 (40.6%)	6 (12.5%)	0.004

*NS indicates nonsignificant; TLR, target lesion revascularization.
†Including 4 patients from group A and 1 from group B presenting non-fatal infarction who later underwent TLR.

patients by restenosis for the second time in the stent from the first procedure. Revascularization of the target lesion due to the reappearance of angina or inducible ischemia (without presenting infarction) was also required in 6 group A patients and 3 group B patients, respectively.

Thus, a total of 14 patients required TLR per year, of whom 10 were from group A and 4 from group B (31.3 vs 8.3% in groups A and B, respectively; *P*=.008). Of the 10 patients from group A, half presented stent restenosis of the target lesion only, and the other half also presented a second restenosis of the stent that had been implanted in the previous procedure in another location (and which had been treated with an in-stent CS or balloon in the second procedure).

The survival analysis showed that the group A patients (59.4%) had lower 1-year event-free survival that those in group B (87.5%), with clearly significant differences (log-rank test, 9.27; *P*=.002). Figure shows the 1-year event-free survival curves.

Predictors of Major Events and Target Lesion Revascularization

Table 3 shows the clinical, angiographic, and procedural parameters studied in the univariate analysis. Previous stent restenosis, a history of infarction and a small vessel (stent required ≤2.75 mm) was associated with greater incidence of major events at 1 year. These three variables were introduced into the Cox multivariate regression analysis, as well as diabetes as a potentially confounding variable. The only independent predictor of major events was previous stent restenosis ([HR]=3.85; 95% CI, 1.46-10.18; *P*=.007), with a small vessel bordering on being significant (Table 4).

On the other hand, an increased need for TLR at 1 year was associated with evidence of previous stent restenosis, diabetes and a small vessel, although in the multivariate analysis the only independent predictors of TLR were previous stent restenosis and a small vessel. Tables 3 and 4 present the results of the univariate and multivariate analyses.

In view of the fact that evidence of previous stent restenosis was significantly more frequent in diabetic patients, a prediction model of major events with only

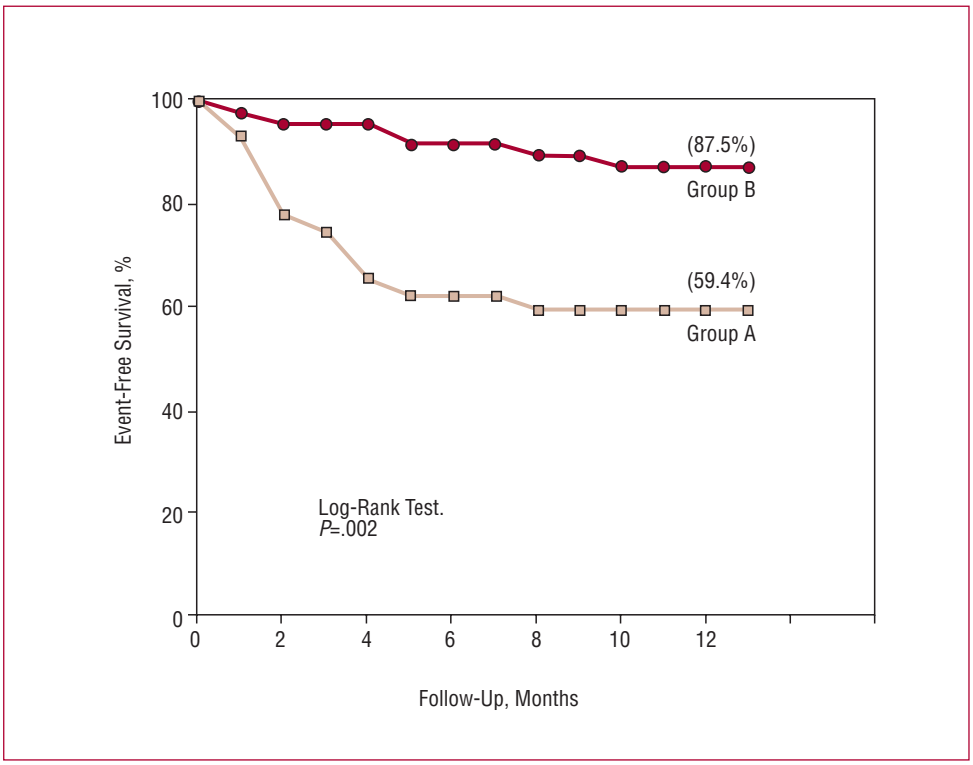

Figure. Kaplan-Meier curves for major event-free survival (death, non-fatal infarction, or target vessel revascularization) after the second procedure for group A (patients with evidence of significant stent restenosis from the previous procedure) and group B (without previous stent restenosis).

TABLE 3. **Univariate Analysis. Predictor Variables of Major Events and Target Lesion Revascularization**

	Major Events		Target Lesion Revascularization	
Variable	**HR (95% CI)**	***P***	**HR (95% CI)**	***P***
Age	1.04 (0.98-1.09)	.13 NS	1.02 (0.96-1.07)	.52 NS
Male sex	1.11 (0.42-2.92)	.83 NS	0.69 (0.24-1.97)	.48 NS
Diabetes mellitus	2.06 (0.83-5.11)	.11 NS	2.90 (1.02-9.16)	.03
Arterial hypertension	1.32 (0.52-3.37)	.55 NS	0.35 (0.10-1.27)	.10 NS
Hyperlipidemia	1.01 (0.38-2.64)	.99 NS	1.16 (0.37-3.72)	.79 NS
Smoking habit	1.03 (0.39-2.70)	.96 NS	1.23 (0.41-3.67)	.71 NS
Previous infarction	2.69 (1.08-6.69)	.03	2.62 (0.91-7.55)	.06 NS
Stable angina	1.71 (0.70-4.22)	.23 NS	2.06 (0.72-5.97)	.17 NS
2-3 vessel disease	1.05 (0.42-2.61)	.92 NS	1.44 (0.50-4.11)	.49 NS
Ejection fraction	0.97 (0.94-1.01)	.09 NS	0.99 (0.95-1.03)	.54 NS
Presence of previous restenosis	3.95 (1.50-10.42)	.003	4.59 (1.43-14.68)	.005
Location AD	0.54 (0.18-1.62)	.26 NS	0.55 (0.15-1.96)	.35 NS
Complex lesions (B2/C)	1.58 (0.62-4.01)	.33 NS	1.67 (0.56-4.97)	.36 NS
No. stents/patient	0.89 (0.43-1.81)	.74 NS	0.53 (0.18-1.59)	.25 NS
Stent diameter ≤2.75 mm	2.59 (1.02-6.82)	.04	3.00 (1.03-9.59)	.03
"Total length stented" ≥25 mm	1.53 (0.44-5.24)	.54 NS	1.73 (0.39-7.74)	.47 NS

*AD indicates anterior descending artery; HR, hazard ratio; CI, confidence interval; NS, nonsignificant; TLR, target lesion revascularization.

TABLE 4. **Cox Multiple Regression Analysis. Predictors of Major Events and Target Lesion Revascularization (Including Significant Factors in the Respective Univariate Analysis and Diabetes)***

	Major Events		Target Lesion Revascularization	
Variable	**HR (95% CI)**	***P***	**HR (95% CI)**	***P***
Presence of previous restenosis	3.85 (1.46-10.18)	.007	4.46 (1.39-14.29)	.01
Stent diameter ≤2.75 mm	2.49 (0.98-6.57)	.055 NS	2.88 (1.08-9.21)	.04
Diabetes	1.42 (0.53-3.79)	.40 NS	1.31 (0.42-4.10)	.64 NS
Previous infarction†	2.26 (0.89-5.75)	.09 NS	–	–

*HR indicates hazard ratio; CI, confidence interval; NS, nonsignificant; TLR, target lesion revascularization.
†Previous infarction was not included in the multivariate analysis regarding predicting TLR, due to not reaching statistical significance in the univariate analysis.

two variables, previous restenosis (as the variable under study) and diabetes (as the adjustment variable) was created, yielding hazard ratios similar to those of the previous model (HR=3.95; 95% CI, 1.50-10.42; *P*=.006 and HR=1.48; 95% CI, 0.58-3.80; *P*=.41, respectively). Similarly, the interrelationship between previous restenosis and diabetes (potentially confounding variable) was studied through repeating the Cox regression analysis, but excluding the previous restenosis variable. However, diabetes did not be prove to have any independent influence in predicting major events in this model either (HR=2.11; 95% CI, 0.84-5.26; *P*=.11).

DISCUSSION

The present study confirms the hypothesis that, in the case of coronary disease progression in patients who had previously undergone stent implantation, the presence or absence of previous stent restenosis helps to predict patient evolution after implanting another stent in a new location. Our results indicate that the patients with previous restenosis who have a CS implanted in a new location form a group at high risk of presenting major events at 1-year follow-up, with an incidence of infarction and need for TLR considerably higher than that of patients undergoing a new PCI procedure who do not present previous stent restenosis.

Coronary disease progression is the leading cause of recurrence of angina symptoms 1 year after PCI, and has been associated with classical cardiovascular risk factors, especially diabetes,[3] in addition to higher levels of inflammation markers such as C-reactive protein.[2] In our series of 1207 patients (diabetic and non-diabetic)

who underwent revascularization procedures within a period of 5 years, 80 patients (6%) required a second PCI due to the appearance of significant de novo lesions, following a first procedure carried out on average 19 months previously. In a series of diabetic patients who underwent stent implantation, Loufti et al[4] found that 9% required percutaneous revascularization due to coronary disease progression after an average of 14 months follow-up.

Many factors have been associated with a greater incidence of restenosis after stent implantation, such as clinical, genetic and angiographic ones, as well as those related to the procedure. Multiple studies have consistently demonstrated some of these factors, such as diabetes mellitus,[5,6] long lesions[7] and small vessel diameter,[8,9] although they have also been associated with given locations[5,10] (ostia, anterior descending artery, saphenous vein grafts), chronic occlusions,[11] and restenotic lesions,[12] together with other variables. Several studies have shown that small-sized vessels are more liable to restenosis and the subsequent need for TLR,[8,9] probably due to having reduced ability to adjust neointimal growth to its smaller caliber. In our study, we found that implanting a stent with a diameter ≤2.75 mm was an independent predictor of a greater incidence of TLR, whereas its capacity to predict major events bordered on the threshold of significance in the multivariate analysis. Diabetes mellitus is the most frequently described clinical factor predictive of restenosis,[5,6] due to greater hyperplastic response, which agrees with our findings that associate it with greater need for TLR at 1 year in the univariate analysis, although without it being an independent predictor in the multivariate analysis. Stent length did not have predictive value for TLR in our study, which could be due the sample size being smaller than in other studies.

It is known that treating a restenotic lesion with balloon or in-stent stent often causes restenosis recurrence in the same lesion.[13] However, little is known regarding whether such restenotic behavior tends to repeat itself in the future in other locations or not, in the event of coronary disease progression. Our results support the former hypothesis, and in our series of patients who underwent a second revascularization procedure due to disease progression, we found that the only independent predictor of major events and the main independent predictor of TLR was the presence of significant restenosis of the stent previously implanted in another location. In the patients with previous stent restenosis, the death, non-fatal infarction or TLR rate was 40% at 1 year following the second procedure, basically due to the need for a new TLR (that is, of the de novo target lesion treated in the second procedure), and to a lesser extent, of a greater incidence of myocardial infarctions. Thus, and although systematic follow-up angiography was not done in all the patients, the worse evolution of these patients would be basically due to de novo stent restenosis from the second procedure, to which would be added, in a good percentage of cases (approximately half, in our series), a second stent restenosis from the first procedure in another location. Such restenosis in at least two locations could trigger cardiac events due to possible reduced collateral circulation in the ischemic territories compared to the absence or presence of restenosis in a single location.

The main finding of our study consists in highlighting the fact that, in cases where revascularization is going to be carried out a second time via PCI due to the appearance of de novo lesions, the information provided by the restenotic response to a previous stent is very useful, since it is better than that provided by other classical factors such as diabetes, long lesions, or lesion complexity. The size of the treated vessel alone would offer additional information. All this indicates that, other than the special "local" characteristics of each lesion, there could be an individual predisposition to restenosis accounting for the trend toward repeat restenosis in some patients and not in others. This phenomenon could be explained by genetic factors, and some authors have pointed out an association between restenosis and given genotypes of angiotensin converting enzyme[14] or platelet glycoprotein IIIa.[15] In this line, an ambitious study has been designed that will include more than 300 patients implanted with stents and attempt to include the genetic determinants involved in the response to vascular injury.[16]

Although the recent introduction of DES has involved a marked reduction in restenosis rates in almost all the patient subgroups and lesions,[17-20] their higher cost means that they are being introduced into many health systems gradually. At present, the interventionist cardiologist is in the dilemma of selecting patients for DES or CS implantation, based on cost-effectiveness criteria. A recent economic study done in Spain[21] concluded that the "neutral" price of a DES (a price involving a trade-off between its higher cost and money saved by avoiding a new revascularization procedure due to restenosis) would be based on the price of a CS, and a formula used to calculate this "neutral" price. In addition, it has been stated[22] that implanting a DES in a lesion is cost-effective when the rate of expected TLR with a CS in this lesion is higher than 12%, and that costs are saved if it is higher than 20%. In our study with CS, the patients with previous stent restenosis exceeded this rate by a wide margin (31%), whereas this was 8% in the patients without previous stent restenosis, and thus implanting a CS could be quite cost-effective in the latter group.

Clinical Applicability

From a practical standpoint, in those patients where a second PCI procedure is done due to coronary disease

progression, the information contributed by behavior in response to previous stenting can be a useful decision-making tool regarding which type of stent to implant. Thus, the findings of our study lead us to suggest implanting DES in all the patients with significant de novo lesions and evidence of previous stent restenosis, regardless of other factors predictive of restenosis, such as diabetes or the characteristics of the lesion. On the other hand, in patients not presenting previous CS restenosis, implanting a CS seems reasonable, especially when locating this in a vessel more than 2.75 mm in diameter. In any case, the relevance of other "classical" restenosis predictors should not be forgotten during the decision-making process. Larger prospective studies are recommended to confirm our findings, and it would be of great interest to implement a multicenter study aimed at testing the hypothesis of the possible existence of individual predispositions to restenosis.

Limitations

The study is limited by being retrospective and that coronary angiography was only done at follow-up based on the clinical criteria of spontaneous or inducible ischemia, rather than systematically carried out. The modest size of the sample may have reduced the predictive value of some variables. The groups with and without previous stent restenosis were comparable, except for a greater incidence of diabetes, female sex, and de novo stent implantation in the anterior descending artery in the previous stent restenosis group, which could indicate a greater a priori risk in this group. However, none of these factors were associated at follow-up with a greater incidence of events and TLR, with the exception of diabetes, which was associated with a higher TLR rate in the univariate analysis, although not in the adjusted multivariate analysis. Finally, it is worth recalling that these results are not applicable to patients who have undergone revascularization procedures with DES. The possibility that DES can improve prognosis in patients predisposed to repeat restenosis should be confirmed in further studies.

CONCLUSIONS

In the patients undergoing a second CS implantation procedure due to coronary disease progression, evidence of previous stent restenosis is associated with a high incidence of major events, as well as TLR, demonstrating independent prognostic value higher than the other variables analyzed. On the other hand, the absence of previous CS restenosis is associated with favorable evolution if a new CS is required. This information can be useful in decision-making in stent selection (CS or DES) in these patients.

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