One year follow-up outcome in multivessel percutaneous coronary intervention

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ABSTRACT

Introduction: Percutaneous coronary intervention in multivessel disease is a valid option for revascularization.
Objective: To assess the outcomes of multivessel percutaneous coronary intervention in patients with multivessel disease; and to identify variables that are predictors of major adverse cardiac events.
Method: A retrospective cohort and long-term survival study at the Hermanos Ameijeiras Hospital. Minimum follow-up was one year. The survival function was estimated by the Kaplan-Meier analysis, and univariate and multivariate analysis were used to identify predictors of major adverse cardiac events.
Results: A total of 191 lesions were treated in 87 patients, 11.5% of them had three-vessel disease. The procedure was successful in 97.7% of cases, and radial access was the most commonly used (67.8%). The left anterior descending artery was the most frequently treated one (41%) and 77% of lesions treated were complex lesions (B2 and C). Some type of major adverse cardiac events occurred in 14.9% of the patients; 3.4% of them died from cardiac causes, 2.3% suffered a nonfatal acute myocardial infarction and 10.3% required repeat revascularization. The rate of adverse event-free survival at one year was 89.16%. Three-vessel disease was the only variable that predicted, independently, the occurrence of major adverse cardiac events at one year [p = 0.01, OR 5.03 (1.18 to 21.3, 95% CI)].
Conclusions: Multivessel percutaneous coronary intervention, in properly selected cases, leads to good results one year after surgery. Three-vessel disease was associated, independently, with the occurrence of major adverse cardiac events during the follow-up.
Key words: Percutaneous coronary intervention, Multivessel coronary artery disease, Major adverse cardiac events

Resultados al año del intervencionismo coronario percutáneo multiarterial

RESUMEN

Introducción: El intervencionismo coronario percutáneo en la enfermedad multivaso constituye una válida opción de revascularización.

Objetivo: Evaluar los resultados del intervencionismo coronario percutáneo multi-arterial en pacientes con enfermedad multivaso, e identificar variables predictoras de complicaciones cardíacas graves.

Método: Estudio de cohorte retrospectivo y de supervivencia a largo plazo en el Hospital "Hermanos Ameijeiras". El seguimiento mínimo fue de un año. La función de supervivencia fue estimada por el método de Kaplan-Meier y se aplicaron análisis uni y multivariado para la identificación de los factores predictores de complicaciones cardíacas graves.

Resultados: Fueron tratadas 191 lesiones en 87 pacientes, el 11,5 % presentó enfermedad de tres vasos. El procedimiento fue exitoso en el 97,7 % de los casos y el acceso radial fue el más empleado (67,8 %). La arteria descendente anterior resultó la más frecuentemente tratada (41 %) y el 77 % de las lesiones abordadas fueron complejas (B_2 y C). El 14,9 % de los casos presentó alguna complicación cardíaca grave; 3,4 % fallecieron por causa cardíaca, 2,3 % padeció un infarto agudo de miocardio no fatal y el 10,3 % requirió nueva revascularización. La tasa de supervivencia libre de sucesos adversos al año de seguimiento fue de 89,16 %. La enfermedad de tres vasos resultó la única variable que predijo, de forma independiente, la aparición de complicaciones cardíacas graves al año [p=0.01, OR 5,03 (1,18-21,3; 95 % IC)].

Conclusiones: El intervencionismo coronario percutáneo multiarterial, en casos adecuadamente seleccionados, deriva en buenos resultados al año de la intervención. La enfermedad de tres vasos se asoció, de forma independiente, a la ocurrencia de complicaciones cardíacas graves durante el seguimiento.

Palabras clave: Intervencionismo coronario percutáneo, Enfermedad coronaria multivaso, Complicaciones cardíacas graves

INTRODUCTION

In Cuba, heart diseases are the second leading cause of death, and 69% of them are due to ischemic heart disease[1]. Approximately 60% of patients with ischemic heart disease who are referred for coronary angiography have multivessel disease (MVD), that is, an involvement of two or more epicardial arteries, including the left main coronary artery (LMCA)[2].

The MVD may be treated by percutaneous coronary intervention (PCI) or coronary artery bypass grafting. Since its emergence in the sixties, coronary artery bypass is the most accepted treatment. Survival for both methods is similar, although PCI has always been associated with higher rates of reoperation, which have been progressively reduced with the advances in the technology of intravascular devices. The indication of either method depends on the clinical setting, the coronary anatomy, the extent of ischemia in noninvasive testing, and other prognostic factors such as diabetes mellitus and depressed left ventricular function[3]. The evidence from the SYNTAX study, designed to identify the optimal method of revascularization in patients with MVD and LMCA disease, depending on the anatomical complexity, indicates that coronary bypass remains the gold standard in the treatment of these patients; however, in certain cases, PCI may be safely performed with results comparable to surgery[4].

In selected cases, PCI may be an attractive option to treat multiple vessels, without losing sight of its limitations, which may be associated with a high rate of survival free of adverse events[5].

The present study was designed to evaluate the outcomes of multivessel PCI in patients with MVD, and identify variables that are predictors of major adverse cardiac events (MACE) at one year.

METHOD

Retrospective cohort and survival study including 87 consecutive patients with severe MVD who underwent PCI at the Hermanos Ameijeiras Hospital from September 2009 to December 2010.

The presence of stenosis greater than 70% in the left anterior descending artery, circumflex artery and right coronary artery, and exceeding 50% in the case

of LMCA, was considered to be a severe MVD.

The severity of injuries and other angiographic data were estimated visually, and the selection of patients was based on the collective discussion of at least three interventional cardiologists with more than 5 years of experience. Clinical, angiographic, and procedure variables were analyzed; as well as the presence of MACE during follow-up (minimum 1 year).

MACE was defined as: cardiac death, nonfatal acute myocardial infarction (AMI) and the need for a new target lesion revascularization (TLR).

Univariate analyzes were performed using the chi-square (χ^2) or Fisher's exact test (as applicable) in order to analyze the possible relationship between the occurrence of MACE and each of the variables of interest.

A logistic regression (multivariate analysis) was performed to determine the predictive value of the variables that were analyzed in the occurrence of MACE. It included the variables that showed significant association ($p < 0.05$) in the univariate analysis, and other ones which were of interest.

The survival function was estimated by the Kaplan-Meier method for all combined MACE (cardiac death/ nonfatal AMI/TLR).

RESULTS

There was a predominance of male patients (78.2%), with an average of 62 years of age. The predominant coronary risk factors included hypertension (74.7%) and smoking (49.4%); and stable effort angina was the most frequent clinical diagnosis, found in 60.9% of cases (**Table 1**).

A total of 191 lesions were treated in 181 diseased vessels, with a mean of 2 lesions per patient. The left anterior descending artery was the most treated one (40.9%), followed by the circumflex artery (30.9%) and the right coronary artery (26.5%). Only 11.5% of patients had three-vessel disease and none had severe LMCA involvement. Complex lesions (type B2 or C) were found in 77% of patients; and bifurcation lesions (11.5%) and chronic total occlusions (13.8%) were uncommon (**Table 2**).

Procedural success (residual stenosis less than 20%, TIMI 3 flow and absence of in-hospital MACE) was achieved in 85 patients (97.7%) and complete revascularization in 61 patients (70.1%). Transradial access was the most commonly used approach (67.8%), 2.57 stents were implanted per patient, and 4 or more

stents were implanted in 14.9% of patients (**Table 3**). Direct stenting was used in 33 patients (37.9%), and drug-eluting stents were used only in 9 patients (10.3%). The mean reference diameter of the treated

Table 1. Baseline characteristics of the study patients (n = 87).

Variables	Nº	%
Male	68	78,2
Hypertension	65	74,7
Smoking	43	49,4
Dyslipidemia	26	29,9
Diabetes mellitus	14	16,1
Obesity	6	6,9
Previous AMI	33	37,9
Previous revascularization	18	20,7
Chronic stable angina	53	60,9
NSTE-ACS	30	34,5
STE-ACS	4	4,6
LVEF ≤ 40%	7	8,0
Age (mean ± SD)	62,02 ± 8,83	

Source: Personal medical records

Table 2. Distribution according to angiographic variables.

Angiographic variables	Nº	%
Left anterior descending *	74	40,9
Circumflex *	56	30,9
Right coronary *	48	26,5
Left main coronary *	3	1,7
3-vessel disease **	10	11,5
Complex lesions (B$_2$/C)**	67	77,0
Bifurcation lesion **	10	11,5
Presence of thrombi **	4	4,6
Chronic total occlusion **	12	13,8
Treated lesions (mean ± SD)	2,2 ± 0,6	

Source: Personal medical records
* n= 181, ** n = 87

Table 3. Distribution according to procedure-related variables (n = 87).

Procedure-related variables	Nº	%
Success of the procedure	85	97,7
Complete revascularization	61	70,1%
Radial access	59	67,8
Femoral access	14	16,1
Humeral access	13	15,0
Cubital Access	1	1,1
Placement of 4 or more stents	13	14,9
Direct stenting	33	37,9
Drug-eluting stent	9	10,3
Implanted stents (mean ± SD)	2,57 ± 0,8	
Diameter of treated vessels (mean ± SD)	2,79 ± 0,422	
Total length of the treated segment (mean ± SD)	47,18 ± 22,2	

Source: Personal medical records

Table 4. Distribution by presence of MACE.

MACE	Nº	%
Nonfatal AMI	1	1,15
Need of a new TLR	9	10,3
Death	3	3,4
Death/TLR/Nonfatal AMI	13	14,9

Source: Personal medical records

cardiac death (3.4%) and nonfatal AMI (2.3%).

Multivariate analysis results are shown in **Table 5**. Of the variables included in the model, only the presence of three-vessel disease was associated, independently, with MACE during the follow-up [p = 0.01, OR 5.03 (1.18 to 21.3; 95 % CI). Survival analysis revealed 89.16% survival free of MACE at one year (**Figure 1**).

Figure 1. Survival curve.

DISCUSSION

There is no controversy whatsoever regarding the fact that about two thirds of patients with a complex coronary artery disease (three-vessels/LMCA) should undergo surgery as the treatment of choice[5]. Either
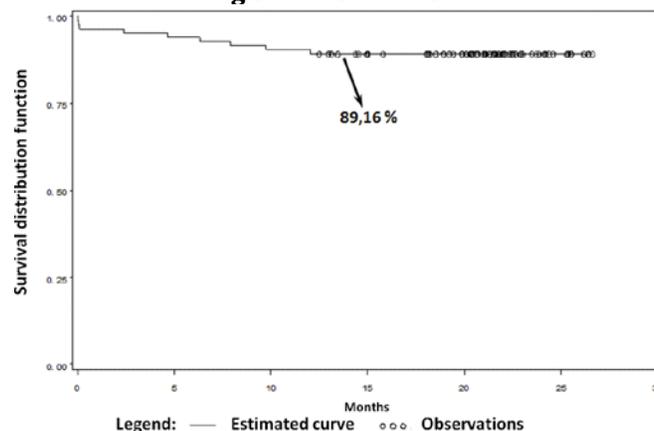
vessels was 2.79 ± 0.4 mm and the total length of the segment where the stents were implanted was about 47 mm

Table 4 shows that 13 patients (14.9%) had some type of MACE during the follow-up. The need for a new TLR was the most frequent one (10.3%), followed by

Table 5. Results of the multivariate analysis.

Variables	p	OR*	IC 95% para el OR	
			Límite inferior	Límite superior
Clinical diagnosis	0.6961	0.2522	0.0522	1.2193
Diabetes mellitus	0.1452	0.1545	0.0087	2.7536
Anterior descending	0.9497	2.3226	0.2756	19.5752
LMCA	0.3575	3.0000	0.2520	35.7175
Three-vessel disease	**0.0103**	5.0370	1.1891	21.3361
Left ventricular dysfunction	0.6137	0.9444	0.1042	8.5591
Radial approach	0.5324	1.3750	0.2683	7.0463
Number of stents	0.0527	-	-	-
Stent length	0.6421	-	-	-

because their anatomy is not suitable for PCI or due to the presence of comorbidities, such as diabetes mellitus, the results are better with the bypass. In the remaining patients, PCI is a suitable alternative[6]. In analyzing the results of the SYNTAX study[4], with regard to the distribution in tertiles of SYNTAX score, which was designed to establish the complexity of coronary anatomy, it seems clear that those in the lowest tertile (SYNTAX score < 23) are the best candidates for PCI. In these patients, the cumulative rate of adverse events compared with surgery is 13.5% vs. 14.4%; p = 0.71.

Our study did not include patients with three-vessel disease associated with LMCA disease, and the number of patients with three-vessel disease, bifurcation lesions and chronic total occlusions was small, when compared with reports from other authors[7,8]. Therefore, the patients treated had a less complex coronary anatomy, within the broad spectrum of MVD, and had a more favorable clinical profile.

A systematic review of 22 randomized controlled studies, where coronary artery bypass graft was compared with PCI with balloon angioplasty or bare metal stent implantation, shows that during the first year of monitoring the need for coronary revascularization after PCI was 26.5%[9]. In this series, this variable is close to 10%, despite the reduced use of drug-eluting stents, which shows that the selection of patients in this context is of paramount importance to ensure good long-term results.

It is interesting to note the extensive use of transradial access in our study, whose main advantage is reducing vascular complications and bleeding. MORTAL study[10] researchers detected a 50% reduction in the transfusion rate and a relative reduction in mortality at 30 days and at one year, 29% and 17% respectively (p=0.001), with the use of the radial approach. In our study, we found no association between the vascular access pathway and a lower occurrence of adverse events, although major bleeding was not included among our variables, as no cases were reported.

Complete myocardial revascularization has traditionally been associated with better long-term clinical outcomes after PCI or coronary artery bypass graft. Incomplete revascularization following PCI is common and occurs in 41-67% of patients with MVD[4,11-13], which is in agreement with our findings. In the SYNTAX study, complete anatomical revascularization was achieved in 56.7% of patients undergoing PCI; however, its prognostic benefit has been questioned in

light of current evidence[13]. The COURAGE study[14] failed to demonstrate a benefit of revascularization with the use, mainly, of bare-metal stents compared with optimal medical therapy, despite being a low-risk population with no complex coronary artery disease. PCI was only beneficial in those patients with significant ischemia which was demonstrated through a non-invasive functional test. And those with three-vessel disease have a worse prognosis than those with one or two vessels disease[15]; in fact, in this research, it was the only independent predictor of MACE during the follow-up. The three-vessel intervention involves the use of a greater number of coronary stents, which increases the risk of restenosis[16,17], probably related to the greater surface that is covered by the stents.

CONCLUSIONS

Multivessel percutaneous coronary intervention, in properly selected cases, had good results during the first year of follow-up. A successful teamwork in decision making and a proper selection of patients were factors that favored these results. Three-vessel disease was associated, independently, with the occurrence of MACE during the follow-up.

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