

Diabetic patients with multivessel coronary disease treated by percutaneous coronary intervention

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Este artículo también está disponible en español

ARTICLE INFORMATION

Received: May 22, 2013

Modified: July 11, 2013

Accepted: August 22, 2013

Competing interests

The authors declare no competing interests

Acronyms

AMI: acute myocardial infarction

CABG: coronary artery bypass graft

CRFs: coronary risk factors

HT: hypertension

PCI: percutaneous coronary intervention

On-Line Versions:

Spanish - English

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ABSTRACT

Introduction: Coronary heart disease is the leading cause of morbidity and mortality in diabetic patients. Many studies have compared medical therapy plus percutaneous intervention with medical therapy plus surgery in diabetic patients with multivessel disease. Bypass surgery remains the treatment of choice.

Objective: To characterize diabetic patients with multivessel coronary disease treated by percutaneous coronary intervention.

Method: An observational, descriptive and cross-sectional study was conducted in 57 diabetic patients with multivessel coronary disease who were treated by percutaneous coronary intervention at the laboratory of hemodynamics of the Hermanos Ameijeiras Hospital from January 2010 to July 2011.

Results: There was a predominance of male patients (66.66 %), and the group aged 50-64 years was the most affected one (36.85%). The most common cardiovascular risk factor was hypertension (54.38 %), followed by dyslipidemia (49.12 %). Dyslipidemia and smoking predominated in the most affected age group. The most common diagnosis was stable angina (45 patients, 78.95%). The type of stent that was most commonly used was the drug-eluting stent (54.39 %), and the artery that most commonly underwent revascularization was the left anterior descending artery (36 patients, 63.15 %).

Conclusions: An association was found between the patients without angiographic success and the presence of dyslipidemia and obesity, and between the patients without procedural success and smoking and obesity.

Key words: Multivessel coronary disease, Diabetes mellitus, Angioplasty, Stent

Pacientes diabéticos con enfermedad coronaria multivaso tratados mediante intervencionismo coronario percutáneo

RESUMEN

Introducción: La enfermedad coronaria es la principal causa de morbilidad y mortalidad en los pacientes diabéticos. Muchos estudios han comparado el tratamiento médico más intervencionismo percutáneo con tratamiento médico más cirugía, en pacientes diabéticos con enfermedad de múltiples vasos. La cirugía de revascularización continúa siendo el tratamiento de elección.

Objetivo: Caracterizar los pacientes diabéticos con enfermedad coronaria multivaso, tratados mediante intervencionismo coronario percutáneo.

Método: Estudio observacional, descriptivo y transversal en 57 pacientes diabéticos con enfermedad de múltiples vasos, tratados mediante intervencionismo coronario percutáneo en el Laboratorio de Hemodinámica del Hospital "Hermanos Ameijeiras", entre enero de 2010 y julio de 2011.

Resultados: Predominaron el sexo masculino (66,66 %) y el grupo entre 50-64 años (36,85 %). El factor de riesgo cardiovascular más identificado fue la hipertensión arterial (54,38 %), seguido de la dislipidemia (49,12 %). En el grupo de edad más representado predominó la dislipidemia y el hábito de fumar. El diagnóstico más observado fue la angina de esfuerzo estable (45 pacientes, 78,95 %). El tipo de stent más utilizado fue el liberador de fármaco (54,39 %) y la arteria más revascularizada fue la descendente anterior (36 pacientes, 63,15 %).

Conclusiones: Se encontró una relación entre los pacientes sin éxito angiográfico con la dislipidemia y la obesidad; y entre los pacientes sin éxito del procedimiento, con el tabaquismo y también con la obesidad.

Palabras clave: Enfermedad coronaria multivaso, Diabetes mellitus, Angioplastia, Stent

INTRODUCTION

In Cuba, in 2012, heart diseases occupied the second leading cause of death with 22,234 deaths, with an adjusted rate of 104.5 per 100,000 inhabitants¹. Within these, the first place was for ischemic diseases with 15,305 deaths, representing a rate of 136.0 per 100,000 inhabitants¹.

Coronary heart disease is the leading cause of morbidity and mortality in diabetic patients. In the United States, approximately one and half million coronary interventions per year are performed, between coronary artery bypass graft (CABG) and percutaneous coronary intervention (PCI), and it is estimated that 25 % of these patients are diabetics. Because of disease impact on the cardiovascular system, affected patients not only require a specific treatment for diabetes, but also for associated ischemic heart diseases².

Diabetes mellitus causes changes in the endothelium and vascular smooth muscle, platelet dysfunction, vasoconstriction and proliferative response in lesion sites³. Hyperglycemia decreases nitric oxide concentration and causes endothelial dysfunction. It also induces an overproduction of free radicals, protein kinase C and prostanoids, which in turn can induce vasoconstriction and the release of proinflammatory cytokines. Insulin stimulates the production of nitric oxide that causes vasodilation and inhibition of platelets. Therefore, metabolic control of diabetes is extremely important³⁻⁴.

Myocardial revascularization by surgery or PCI, combined with optimal medical therapy, produces

higher survival and symptomatic relief than medical treatment alone, in patients with moderate or serious coronary heart disease⁵⁻⁷.

Multiple clinical trials have compared both therapeutic procedures⁸⁻¹⁸ and results have found superiority of either one or the other.

The objectives of this research were to characterize diabetic patients with multivessel coronary disease treated by percutaneous coronary intervention, for which the age and sex of the study population, coronary risk factors (CRFs), clinical diagnosis, revascularized artery, the type of stent used, angiographic success and procedural success, were taken into account. Furthermore, to evaluate the relationship of CRFs with angiographic success and procedural success.

METHOD

Population and type of study

A research and development, observational, descriptive and transversal study was performed. The study population consisted of 57 diabetic patients with multivessel coronary disease treated by PCI in the Catheterization Laboratory of Hermanos Ameijeiras Hospital, between January 2010 and July 2011.

Inclusion and exclusion criteria

All diabetic patients with multivessel disease, who underwent PCI and had all their data completed on

the database were included.

Those who did not meet the inclusion criteria were excluded.

Information gathering

The Catheterization Laboratory database of that hospital and medical records of patients were reviewed.

Variables

The variables sex, age, CRF [smoking, hypertension (HT), obesity and dyslipidemia], clinical diagnosis (stable exertional angina or acute coronary syndrome without ST segment elevation), revascularized artery and type of stent used (conventional or pharmacocactive) were assessed.

Angiographic success was considered when the reduction of minimal residual stenosis diameter was ≤ 20%; and procedural success, when angiographic success was achieved in the absence of major complications, such as acute myocardial infarction (AMI), emergent coronary surgery or death during hospital stay.

Statistical analysis

To summarize the information of the variables, and to estimate the degree of trend or relationship level between CRFs and angiographic success, and between CRFs and the procedural success, frequency distribution was used. The parametric Chi square (X²) technique was used to relate two quantitative variables.

RESULTS

Of the patients who underwent PCI with stenting in the period selected, 57 were part of the study, whose ages ranged between 40 and 79 years. The age group

most commonly found was between 50 and 59 years (**Table 1**).

Hypertension was the most commonly found risk factor (31 patients for 54.38%), followed by dyslipidemia with 28 cases (49.12 %), and the most represented age group (50-59 years), the risk factor most commonly identified was dyslipidemia, followed by smoking with 11 and 10 patients, respectively (**Table 2**).

Table 1. Distribution of the study population, by age group and sex. Hermanos Ameijeiras Hospital 2010-2011.

Variables	Nº	%
Age groups (years)		
40 - 49	8	14,03
50 - 59	21	36,84
60 - 69	18	31,57
70 - 79	10	17,54
Sex		
Male	38	66,67
Female	19	33,33
Total	57	100

Source: Catheterization Laboratory database. Hermanos Ameijeiras Hospital.

Table 2. Frequency of some FRCs divided by age group (n=57).

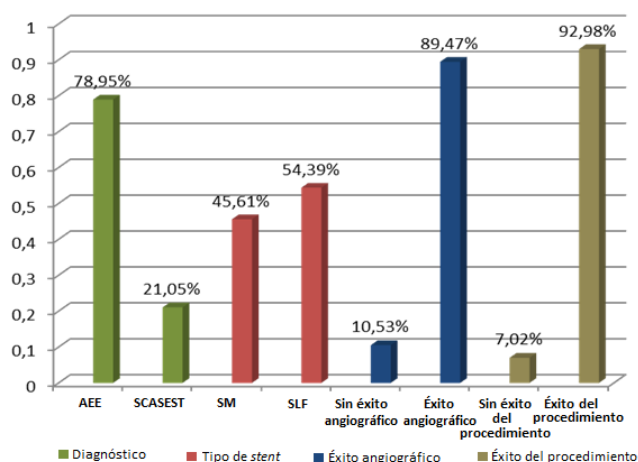
CRFs	Age groups (years)								Total	
	40-49		50-59		60-69		70-79			
	Nº	%	Nº	%	Nº	%	Nº	%		
Smoking	5	19,2	10	38,46	7	26,92	4	15,38	26	45,61
Obesity	9	52,9	3	17,64	3	17,64	2	11,76	17	29,82
Hypertension	9	29,0	8	25,8	9	29,03	5	16,12	31	54,38
Dyslipidemia	7	25,0	11	39,28	4	14,28	6	21,42	28	49,12

Table 3 shows that the most revascularized artery was the left anterior descending, 36 patients (63.15 %), followed by the right coronary artery, 16 (28.07%).

45 patients with clinical diagnosis of stable effort angina (78.94%) were identified. Drug-eluting stent was the most used type of stent, which was used in 31 of them (54.39%) compared to 26 (45.61%) conventional stents (**Figure**). Angiographic success could not be achieved in 6 patients, for a 10.52% and only in 4

Table 3. Revascularized arteries, by sex (n=57).

Revascularized artery	Sex		Total	
	Female	Male	Nº	%
Left common trunk	3	4	7	12,28
Anterior descending	9	27	36	63,15
First diagonal	2	1	3	5,26
Circumflex	5	5	10	17,54
First oblique marginal	3	3	6	10,52
Right coronary	7	9	16	28,07
Others	2	1	3	5,26

Figure. Clinical diagnosis, type of stent, and angiographic and procedural success in treated patients.**Table 4.** Relationship between the selected CRFs and the absence of angiographic success (n=6).

CRFs	Nº	%	p value	Chi
Dyslipidemia	6	100	0,0084036	6,95
Smoking	4	66,66	0,2737071	1,2
Hypertension	2	33,33	0,1425998	2,15
Obesity	5	83,33	0,0024551	9,17

Table 5. Relationship between the selected CRFs and the absence of procedural success (n=4).

CRFs	Nº	%	p value	Chi
Dyslipidemia	3	75	0,2830009	1,15
Smoking	4	100	0,0235269	5,13
Hypertension	2	50	0,6453830	0,21
Obesity	3	75	0,0405497	4,19

the procedure was not successful (7.01 %).

A statistically significant relationship was found between dyslipidemia ($p = 0.0084036$) and obesity ($p = 0.0024551$), in cases without angiographic success (**Table 4**) and between smoking ($p = 0.0235269$) and obesity ($p = 0.0405497$), in those without procedural success (**Table 5**).

DISCUSSION

Although the preferred revascularization treatment in diabetic patients with multi-vessel coronary disease is surgical¹⁹; technical advances, use of drug-eluting stents, the operator's experience and patient individualization, allow the successful use of PCI in certain cases.

The association between certain lifestyle habits, personal characteristics and CRFs with atherosclerotic disease has been demonstrated in several studies²⁰. Some research has shown that hypertension is an independent predictor of coronary disease²¹. It is known that increased wall stress caused by hypertension, stimulates the atherosclerotic process²².

The prevalence of hypertension in diabetics is about twice that in the nondiabetic population, accelerating the progression to chronic kidney disease²³⁻²⁴.

Diabetic dyslipidemia is characterized by moderate

hypertriglyceridemia, decreased high density lipoproteins and presence of small, dense, low-density lipoproteins, which are highly atherogenic, and although total cholesterol is generally normal, an increase of its blood concentrations that have no clinical significance in the non-diabetic subject, does increase the cardiovascular risk 2-3 times in the diabetic subjects²⁴.

Hypertriglyceridemia is considered as an independent predictor of cardiovascular disease, and elevation in plasma of triglyceride-rich lipoproteins in diabetic subjects is associated with the severity of co-

ronary atherosclerosis^{24,25}.

In this study, the most found CRFs were hypertension, followed by dyslipidemia, which shows the latter's association with coronary artery disease in diabetic patients.

Autopsy data demonstrate that coronary atherosclerosis in diabetics is more intense, with involvement of a greater number of vessels, a more diffuse distribution, with a greater number of complicated, ulcerated plaques and with thrombus than in the non-diabetic population^{25,26}. Angiographic studies confirmed diffuse and more extensive lesions, with less collateral circulation and increased presence of risk plaques. Diabetics show a faster growth of lesions when compared with repeated studies in the same patient. The new intracoronary screening procedures (ultrasound and optical coherence tomography) confirm the presence of a greater number of "hot" plaques and a higher rate of complications^{25,26}.

Many comparative trials have been published. Base-line studies as the CASS (Coronary Artery Surgery Study)⁸, Veterans Administration Cooperative Study⁹ and ECSS (European Coronary Surgery Study)¹⁰ showed that high-risk patients with chronic stable angina were the most benefited from surgical revascularization¹⁰. The MASS- II study (Medicine, Angioplasty or Surgery Study II)¹¹ compared medical treatment with PCI and CAGB in high-risk patients with multivessel disease, and confirmed the superiority of CAGB against PCI in terms of survival, relief of anginal symptoms and need for reintervention¹¹.

The ERACI II (acronym for Argentine randomized trial for coronary angioplasty with stenting versus CAGB), in patients with multivessel coronary disease^{12,13} found a lower mortality at 30 days in PCI, however, survival at 5 years and incidence of nonfatal MI were similar in the two groups of treatment¹³.

The CARDia trial (Coronary Artery Revascularisation in Diabetes)¹⁷ compared PCI vs CAGB in diabetic patients with symptomatic multivessel coronary disease. The primary endpoint was a composite of mortality from any cause, AMI and cerebrovascular events. Total mortality rates were equal. Their results at one year indicated that, although angioplasty is a technique that can be performed safely in these patients, its non-inferiority has not been demonstrated in the long-term.

In the SYNTAX trial (SYnergy between PCI with TAXus and Cardiac Surgery)¹⁸, the goal was to compare

serious cardiac and cerebrovascular complications. Both strategies showed a comparable safety profile at 12 months, no difference in mortality, but with less need for new revascularization procedures in the surgical group, differences caused by better surgical outcomes in diabetic patients.

The FREEDOM trial (Future Revascularization Evaluation in Patients with Diabetes Mellitus: Optimal Management of Multivessel Disease)¹⁹, has an impact on clinical guidelines for the treatment of patients with diabetes and multivessel disease. After revascularization, the rate of death from all causes at five years, myocardial infarction and cerebrovascular events, was 26.6 % in patients treated with PCI, and 18.7 % in those who underwent CAGB, a statistically significant reduction of relative risk of 30%. Cerebrovascular event rates were significantly higher in the group with CAGB.

The anterior descending was the most revascularized artery in our research, possibly due to the amount of myocardium that it supplies and the greater symptomatology it may cause. From the standpoint of clinical practice many interventionists can identify high and low risk patients, and thus apply the most appropriate revascularization treatment.

Both PCI and CAGB are complementary revascularization procedures, but there are factors concerning the patient such as risk of cerebrovascular events, his/her fragile state, lung and kidney functions, patient preference, physician experience and other variables that influence on the decision for each case. At the beginning of the century, after the introduction of drug-eluting stents, the good results obtained in randomized trials with selected patients, improvements in antiplatelet therapy and the experience of interventional cardiologists, a phase of revival for PCI began²⁶.

CONCLUSIONS

The age group between 50-59 years and male sex were the most affected. Hypertension, dyslipidemia and smoking were the most frequently found CRFs. The most common clinical diagnosis was stable angina on exertion, the left anterior descending the most revascularized artery and drug-eluting stent was the most used stent. Angiographic success and procedural success predominated, and a statistically significant relationship between dyslipidemia and obesity in

patients without angiographic success was found, and between smoking and obesity in those with no procedural success.

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