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The impact of percutaneous coronary intervention *versus* coronary artery bypass grafting surgery in left main coronary artery disease – a single center experience

Impacto da intervenção coronária percutânea *versus* cirurgia de revascularização do miocárdio na doença do tronco da coronária esquerda – experiência de um único centro

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ABSTRACT – **Background:** Although coronary artery bypass grafting has been considered the gold-standard treatment for stable ischemic left main coronary artery disease, percutaneous coronary intervention has shown good results, and is an alternative to surgery. This study aimed to evaluate and compare a real-world population with stable left main coronary artery disease submitted to coronary artery bypass grafting or percutaneous coronary intervention, regarding their characteristics and outcomes. **Methods:** Two samples of patients with stable ischemic left main coronary artery disease, who underwent coronary artery bypass grafting or percutaneous coronary intervention between January 2015 and November 2018, were evaluated and their clinical outcomes compared. The cumulative event rates were based on the Kaplan-Meier curve and compared with log-rank statistics. Hazard ratio and 95%CI and p-values, were obtained through univariate Cox regressions. **Results:** No significant differences were found between the percutaneous coronary intervention and coronary artery bypass grafting groups in the total composition of risks for major cardiac and cerebrovascular events (hazard ratio of the percutaneous coronary intervention group of 2.066; 95%CI 0.876-4.869; p=0.097) or in the risk of death from cardiovascular cause (hazard ratio for the percutaneous coronary intervention group of 1,117; 95%CI 0.204-6,109; p=0.898). However, the group classified as high coronary artery disease anatomical complexity had worse results regarding major cardiac and cerebrovascular events rates when submitted to percutaneous coronary intervention (hazard ratio of 2.699; 95%CI 1.002-7.266; p=0.049). **Conclusion**: The results obtained suggest that both treatments are valid options for the treatment of stable ischemic left main coronary artery disease, except in patients with high coronary anatomic complexity, in whom coronary artery bypass grafting should remain the treatment of choice.

Keywords: Coronary artery disease; Coronary artery bypass; Percutaneous coronary intervention

RESUMO – **Introdução:** Embora a cirurgia de revascularização do miocárdio seja o tratamento padrão-ouro para a doença estável do tronco da coronária esquerda, a intervenção coronária percutânea mostrou bons resultados, tornando-se alternativa à técnica cirúrgica. Este estudo teve como objetivo avaliar e comparar uma população do mundo real com doença estável de tronco de coronária esquerda submetida à cirurgia de revascularização do miocárdio ou à intervenção coronária percutânea, quanto às suas características e aos seus desfechos. **Métodos:** Duas amostras de pacientes com doença estável do tronco da coronária esquerda, submetidas à cirurgia de revascularização do miocárdio ou à intervenção coronária percutânea entre janeiro de 2015 e novembro de 2018, foram avaliadas, e seus resultados clínicos foram comparados. As taxas de eventos cumulativos foram baseadas na curva de Kaplan-Meier e comparadas com estatísticas de teste de *log-rank*. Os valores de p, razão de risco e IC95% foram obtidos por meio de regressões de Cox univariadas. **Resultados:** Não foram encontradas diferenças significativas entre os grupos submetidos à intervenção coronária percutânea e à cirurgia de revascularização do miocárdio na composição total de riscos de eventos cardíacos e cerebrovasculares adversos maiores (razão de risco do grupo submetido à intervenção coronária percutânea de 2,066; IC95% 0,876-4,869; p=0,097) ou no risco de morte por causa cardiovascular

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(razão de risco de 1,117 no grupo submetido à intervenção coronária percutânea; IC95% 0,204-6,109; p=0,898). Entretanto, o grupo classificado como tendo doença coronariana de alta complexidade anatômica apresentou piores resultados quanto às taxas de eventos cardíacos e cerebrovasculares adversos maiores quando submetidos à intervenção coronária percutânea (razão de risco de 2,699; IC95% 1,002-7,266; p=0,049). **Conclusão:** Ambos os tratamentos são opções válidas para a doença estável do tronco da coronária esquerda, exceto em pacientes com alta complexidade anatômica coronariana, nos quais a cirurgia de revascularização do miocárdio deve permanecer como tratamento de escolha.

Descritores: Doença da artéria coronariana; Ponte da artéria coronária; Intervenção coronária percutânea

INTRODUCTION

Cardiovascular diseases are nowadays the main cause of morbidity and mortality.[1] The incidence of left main coronary artery disease (LMCAD) is estimated between 5% and 7% of coronary artery disease, but may go up to 24% of patients presenting with acute coronary syndrome (ACS).[2-9] Current indications for stable and significant LMCA disease recommend revascularization despite their symptomatic status to improve the patient prognosis.[2,5,7,19]

There are many scoring systems validated to assess patient complexity when choosing the best treatment of LMCAD.[20-29] The most widely used are SYNTAX score, for anatomic complexity, and EuroSCORE, for operative risk assessment.

Over the years, percutaneous coronary intervention (PCI) has become a safe and reliable technique especially due to the introduction of new techniques and types of stents.[30] Studies have been conducted to understand their outcomes implications,[3,16] such as the SYNTAX trial, and more recently, the EXCEL, with Everolimus-stents (XIENCE V®), and the NOBLE,[14] with Biolimus-stents (BioMatrix™).[15,16,30] In the EXCEL and NOBLE trials, repeat revascularization rates were lower than the ones estimated by the SYNTAX trial with first-generation DES, but still higher than coronary artery bypass grafting (CABG).

Despite all the progress made in this field and the technique's safety, PCI is associated with considerable rates of target lesion failure.[5,18,19] Within the overall context, PCI has shown higher rates of repeat revascularization than CABG.[2,15,16,18] For the patients with suitable coronary anatomy for both procedures and low predicted surgical mortality, the 2018 European Society of Cardiology/ European Association for Cardio-Thoracic Surgery (ESC/ EACTS) guidelines assigned Class I-A to both PCI and CABG for LMCAD, with SYNTAX score <23 (considered as low anatomical complexity).[5] For the more complex ones, with SYNTAX scores between 23 and 32 and ≥33, PCI only gets Class IIa-A and III-B indications, respectively, while CABG has Class I-A for both groups. Therefore, with the improvements of PCI, there has been a growing tendency for PCI in stable LMCAD and a growing need to understand its impact in cardiovascular outcomes.

This study aimed to evaluate and compare a real-world population with stable LMCAD submitted to CABG or PCI, regarding their characteristics and outcomes.

METHODS

This was a single-center, retrospective, observational, descriptive and analytical study, according to the proposed objectives.

Population

The study population consisted of patients diagnosed as left main coronary artery disease, treated with CABG or PCI, admitted to a Cardiology Department, between January 2015 and November 2018, and who were followed up for at least 1 year. Patients with one of the following characteristics were excluded from the study: aged under 18 years; documented cardiovascular disease that has known impact on patient survival, including severe structural disease and cardiovascular instability, such as cardiogenic shock, ST-elevation myocardial infarction, non-ST-elevation myocardial infarction associated with hemodynamic instability; history of previous CABG; history of neoplasia or other non-cardiovascular comorbidities responsible for an expected mean lifetime <5 years, documented prior to initiating treatment.

Ethical statement

The study was approved by the Ethics Committee. All study procedures were carried out in accordance with the rules of Ethical Conduct and Good Practice, following the principles of the Declaration of Helsinki and the Convention on Human Rights and Biomedicine.

Endpoints

The primary endpoint of the study was to compare the rates of major adverse cardiac and cerebrovascular events (MACCE) at 1-year and at 3-years post-intervention for the PCI Group with the CABG Group. Other endpoints include the rates of stent restenosis or graft failure with repeat revascularization and the rates of the individual components of MACCE, at 30-days post procedure and at 1- and 3-years post allocation.

Definitions

Death included both cardiovascular and non-cardiovascular causes. Cardiovascular-related death included heart failure, myocardial infarction, cardiogenic shock, and other causes of heart disease. Myocardial infarction was defined as prolonged chest pain or shortness of

breath accompanied by characteristic electrocardiographic changes and increased biomarkers levels (at least one value of cardiac troponin – cTn – >99th percentile upper reference limit). If it occurred ≤48 hours after procedure, it was arbitrarily defined by an elevation of cTn >5 times for the PCI-treated and >10 times for the CABG-treated of the 99th percentile upper reference limit in patients with normal baseline values. MACCE was defined as the composite of all-cause death, myocardial infarction, stroke, and repeat revascularization (via PCI or CABG). Restenosis was assessed with coronary angiography driven by symptoms (chronic or acute coronary syndrome). Graft failure and stent failure (stent thrombosis or stent restenosis) were defined as a flow-limiting stenosis/occlusion within a bypass graft/adjacent to the anastomosis of a previously bypassed coronary artery (for CABG patients) or within/adjacent to a previously successfully stented artery (for PCI patients). Hospital admission motivated by cardiac-related symptoms was considered whenever the patient resorted to the emergency department, with or without hospitalization, due to angina-like symptoms.

Statistical analysis

Data analysis was performed using the IBM Statistical Packge for the Social Sciences (SPSS) program, version 26 (IBM Corporation, 2019). To reduce the effect of treatment-selection bias and potential confounding in this observational study, we applied a propensity score matching, so that we could adjust significant differences in the baseline characteristics of patients in each group. Only the variables that are described in the literature as potential influencers on the outcomes were included in the propensity model, such as age, sex, left ventricular ejection fraction, chronic kidney disease, diabetes mellitus, previous myocardial infarction, anatomical complexity of the disease though the SYNTAX score analysis, and clinical condition at treatment time. We applied the propensity score and made matches in a ratio of 1:1 for the PCI and CABG Groups, to have the most similar samples as possible, resulting in a sample of 35 patients in both groups. The details of the resulting models and their predictive characteristics are described in table 1.

Table 1. Baseline characteristics of the propensity-matched patients

Variable	CABG Group (n=35)	PCI Group (n=35)	Statistical analysis
Demographic characteristics			
Age, years			0.129
Median	69	76	
Interquartile range	11	19	
Sex male	28 (80.0)	24 (68.6)	0.274
BMI, kg/m^2			0.154
Mean	28.77	27.23	
Standard deviation	5.076	3.300	
Cardiac or coexisting conditions			
Diabetes mellitus			0.762
Oral antidiabetic-treated	13 (37.1)	15 (42.9)	
Insulin-treated	6 (17.1)	4 (11.4)	
Hypertension	26 (74.3)	24 (68.6)	0.597
Hyperlipidemia	25 (71.4)	21 (60.0)	0.314
Smoker			0.479
Former smoker (>30 days)	15 (42.9)	10 (28.6)	
Current smoker	3 (8.6)	4 (11.4)	
Previous coronary angioplasty	0	12 (34.3)	<0.001
Previous myocardial infarction	9 (25.7)	15 (42.9)	0.131
History of coronary artery disease	10 (28.6)	19 (54.3)	0.029
History of heart failure	3 (8.6)	1 (2.9)	0.614
Valvular heart disease	31 (88.6)	27 (77.1)	0.205
Valve disease severity			0.124 by FET
Lightly	62 (95.4)	30 (85.7)	
Moderately	3 (4.6)	5 (14.3)	

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Table 1. Baseline characteristics of the propensity-matched patients

Variable	CABG Group (n=35)	PCI Group (n=35)	Statistical analysis
Left ventricular hypertrophy	19 (54.3)	19 (54.3)	1.000
Chronic obstructive pulmonary disease	2 (5.7)	8 (22.9)	0.04
History of cerebrovascular disease	6 (17.1)	4 (11.4)	0.495
Peripheral vascular disease	7 (20.0)	3 (8.6)	0.172
Chronic kidney disease	8 (22.9)	7 (20.0)	0.771
Ejection fraction			0.421
Normal (>50%)	21 (60.0)	26 (74.3)	
Slightly reduced (41-50%)	9 (25.7)	2 (5.7)	
Moderately reduced (31-40%)	4 (11.4)	4 (11.4)	
Severely reduced (<30%)	1 (2.9)	3 (8.6)	
Clinical condition			0.099
Stable coronary artery disease	15 (42.9)	10 (28.6)	
Unstable angina	2 (5.7)	8 (22.9)	
Non-ST-elevation myocardial infarction	18 (51.4)	17 (48.6)	
Medication before treatment			
Aspirin	21 (60.0)	16 (45.7)	0.231
Anticoagulant	4 (11.4)	9 (25.7)	0.129
Beta blocker	14 (40.0)	13 (37.1)	0.806
ACEI	11 (31.4)	12 (34.3)	0.799
Statins	22 (62.9)	21 (60.0)	0.806
Medication post-treatment			
None		1 (2.9)	
Aspirin plus clopidogrel		20 (57.1)	
Aspirin plus ticagrelor		14 (40.0)	
Angiographic characteristics			
Occlusion			0.139
Median	70.0	60.0	
Interquartile range	30.0	30.0	
Location			0.487
Ostium, proximal, midshaft, and/or diffuse	10 (28.6)	11 (36.7)	
Distal and/or bifurcation	25 (71.4)	19 (63.3)	
SYNTAX score			0.151
Median	19	16	
Interquartile range	10	11	
Complementary diagnostic devices			
IVUS	0	18 (51.43)	
FFR	0	1 (2.86)	
OCT	1 (2.86)	0	
Follow-up, days			0.301
Median	704	632	
Interquartile range	436	549	
Causes of death			0.233
Cardiovascular-related	2 (5.71)	2 (5.71)	
Non-cardiovascular related	0	4 (11.43)	
Unknown	2 (5.71)	2 (5.71)	

Results expressed as n (%) or %, if not indicated in another way.
CABG: coronary artery bypass grafting; PCI: percutaneous coronary intervention; BMI: body mass index; ACEI: angiotensin-converting enzyme inhibitors; IVUS: intravascular ultrasound; FFR: Fractional Flow Reserve; OCT: optical coherence tomography.

After performing all propensity-score matches, we compared baseline covariates between the two intervention groups. Continuous data with symmetrical distribution are expressed as means and standard deviations (SD). The decision criterion for symmetry was the framing of the symmetry coefficient in the interval [-1; 1]. Others were expressed as medians and interquartile range (IQR). They were then compared using t-test of independent samples, or the Mann-Whitney U test, according to whether the assumption of normality of distributions in both groups had been verified or not. This assumption was evaluated with the Shapiro-Wilk test, since the sample size did not exceed n=50, in at least one of the groups. The calculated effect size for the Mann-Whitney U tests was $r=Z/\sqrt{n}$ and for the t-test of independent samples was Cohen's d = (means $_2$ – means $_1$)/ SD_{pooled}. Categorical and nominal variables were expressed as counts and percentages, and compared using the Chi-squared test or Fisher exact test, in case of non-compliance with the assumption of a maximum of 20% of cells with an expected frequency of less than 5. This evaluation was complemented with the calculation of the phi effect size for dimension tables 2x2 or Cramer's V, for dimension tables n x n. Ordinal variables were compared using Mann-Whitney U test. Cumulative event rate estimates were obtained from Kaplan-Meier time-to-event analysis and log-rank test statistics. P-values, hazard ratio and 95%CI are from univariate Cox regression procedures. P-values were calculated to assess differences between treatment groups for long-term follow-up endpoints. All reported p-values are two-tailed, and p-values of less than 0.05 were considered to indicate statistical significance.

RESULTS

Demographic and clinical characterization of the sample

Data from patients with LMCAD who were assessed at the center between January 1st, 2015 to November 30, 2018 were analyzed, obtaining a sample of 933 patients. The inclusion and exclusion criteria were then applied, resulting in a sample of 347 patients with the potential to be eligible for this study. After analysis of the sample, it was found that 36 patients were referred for PCI, while 163 were referred for CABG and 148 did not undergo revascularization.

Overall baseline clinical and angiographic characteristics were well balanced between the groups, including the age and the anatomical complexity (median SYNTAX score of the ICP Group of 16; CABG Group of 19; p=0.151). The PCI Group has a significant higher history of coronary heart disease (n=19; 54.3% *versus* n=10; 28.6%; p=0.029) and chronic obstructive pulmonary disease (n=8; 22.9% *versus* n=2; 5.7%; p=0.04). In addition, intravascular imaging tools were more frequently used in the PCI-treated patients, mostly intravascular ultrasound (IVUS), which was performed in 18 (51.4%) patients, in contrast with the CABG, in which only one (2.86%) patient was submitted to an optical coherence tomography. Procedural data specific to each technique is detailed in table 2.

Table 2. Procedural data specific to each technique

PCI (n=35)	
Technique used in bifurcation lesions	
Cullote	4 (23.5)
Provisional stenting (1 stent)	10 (58.8)
Provisional stenting (2 stents)	2 (11.8)
DK crush	1 (5.9)
Type of DES used	
Everolimus	23 (65.7)
Zotarolimus	10 (28.6)
Paclitaxel	2 (5.7)
Motive for undergoing PCI	
Team and patient decision	29 (82.9)
Patient unfit for surgery	4 (11.4)
Patient refuses surgery	2 (5.7)
CABG (n=35)	
Number of revascularized vases	
1	3 (8.6)
2	19 (54.3)
3	13 (37.1)
Number of internal thoracic artery grafts	35 (100.0)

Results expressed as n (%).
PCI: percutaneous coronary intervention; DK: double kissing; DES: drug-eluting stent; CABG: coronary artery bypass grafting.

Outcomes at 30 days 1 year and 3 years

The results of the analyses of the primary and other endpoints up to 30 days are described in table 3; up to 1 year after allocation are described in table 4; up to 3 years, in table 5; and Cox regression survival curves three years after allocation are displayed in figures 1 and 2. The median duration of follow-up was 704 days (IQR of 436) in the CABG Group, and 632 days (IQR of 549) in the PCI Group. Complete three-year follow-up was obtained for 15 patients in the CABG Group and 9 in the PCI Group.

Table 3. Differences of outcomes in both groups at 30 days and after 3 years of allocation

Events	CABG registry (n=35)	PCI Registry (n=35)
30 days after allocation		
MACCE	0	3 (8.57)
All causes of death	0	2 (5.71)
Cardiac death	0	2 (5.71)
Stroke	0	0
Myocardial infarction	0	1 (2.86)
Revascularization	0	0
Stent/graft occlusion	0	0
After 3 years of allocation		
MACCE	19 (26.39)	12 (33.33)
All causes of death	12 (16.67)	9 (25.00)
Cardiac death	4 (5.71)	2 (5.71)
Stroke	6 (8.33)	0
Myocardial infarction	1 (1.39)	2 (5.56)
Revascularization	0	1 (2.78)
Stent/graft occlusion	1 (1.39)	1 (2.78)
PCI	0	1 (2.78)
CABG	0	0

Results expressed as n (%).
CABG: coronary artery bypass grafting; PCI: percutaneous coronary intervention; MACCE: major adverse cardiac and cerebrovascular events.

No significant differences in the composite of death, stroke, myocardial infarction, and revascularization were found between the groups, not at the 1-year follow-up and neither at the 3-year follow-up. Major adverse cardiac and cerebrovascular events rate was more than the double in the PCI Group that in the CABG Group (n=6; 17.14%; *versus* n=13; 37.14%), and occurred more acutely (<30 days). Data regarding the events occurred up to 30-days are shown table 5.

During the 3-year follow-up, 21 patients in the whole sample died, of whom six died of a cardiovascular-associated cause. It was not possible to establish the cause of death in seven patients. At 30 days, more cardiovascular-related death events have occurred in the PCI Group that in the CABG Group (2; 5.71% *versus* zero), accounting for all the cases of cardiovascular death in the PCI group in the 3-year follow-up. On the other hand, in the CABG Group, cardiovascular-related death was more substantial at 3 years, with two cases reported, with the first case reported during the first year, even though no significant difference was found between them.

Table 4. Hazard ratios for clinical outcomes at 1-year follow-up

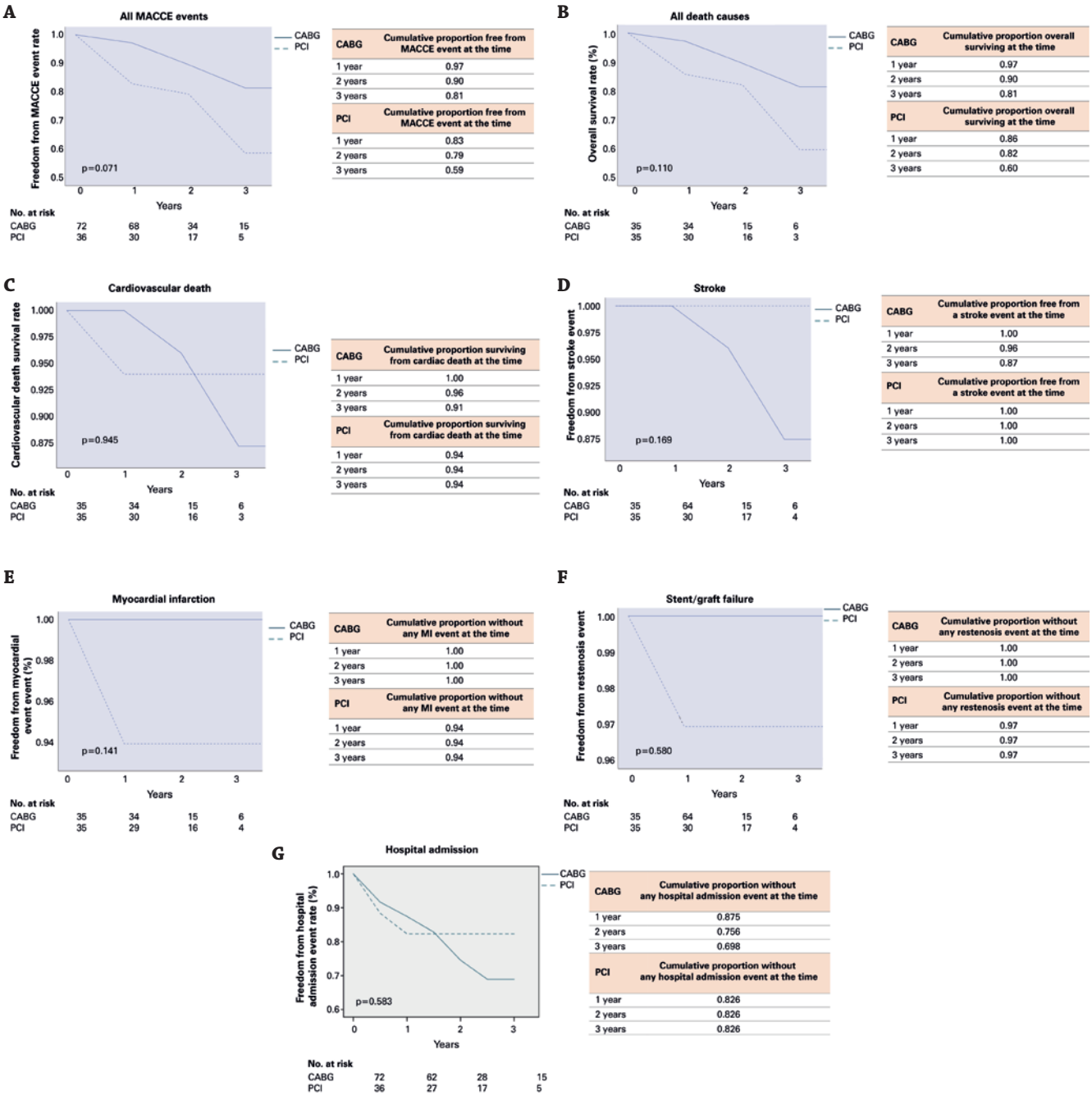
Event	CABG Group (n=35)	PCI Group (n=35)	Coefficients PCI *versus* CABG	Standard error	Hazard Ratio (95%CI)	p-value
MACCE	8 (22.86)	1 (2.86)	1.885	1.080	6.585 (0.792-54.721)	0.081
All causes of death	1 (2.86)	5 (14.29)	1.686	1.096	5.397 (0.630-46.215)	0.124
Cardiovascular death	0	2 (5.71)	*	*	*	*
Stroke	0	0	*	*	*	*
Myocardial infarction	0	2 (5.71)	*	*	*	*
Revascularization	0	0	*	*	*	*
Stent /graft occlusion	0	1 (2.86)	*	*	*	*
PCI	0	0	*	*	*	*
CABG	0	0	*	*	*	*
Hospital admission, due to cardiac symptoms	9 (12.5)	6 (16.67)	1.161	0.913	3.193 (0.533-19.116)	0.204

Results expressed as n (%), if not indicated in another way. Values are given as Kaplan-Meier events rate and calculated by time-to-event analyses with log-rank p-values. This shows recorded after-procedure data.
*We could not apply our statistical tests to many of our secondary endpoints because one of the groups did not report any event.
CABG: coronary artery bypass grafting; PCI: percutaneous coronary intervention; MACCE: major adverse cardiac and cerebrovascular events.

Table 5. Hazard ratios for clinical outcomes at 3-year follow-up

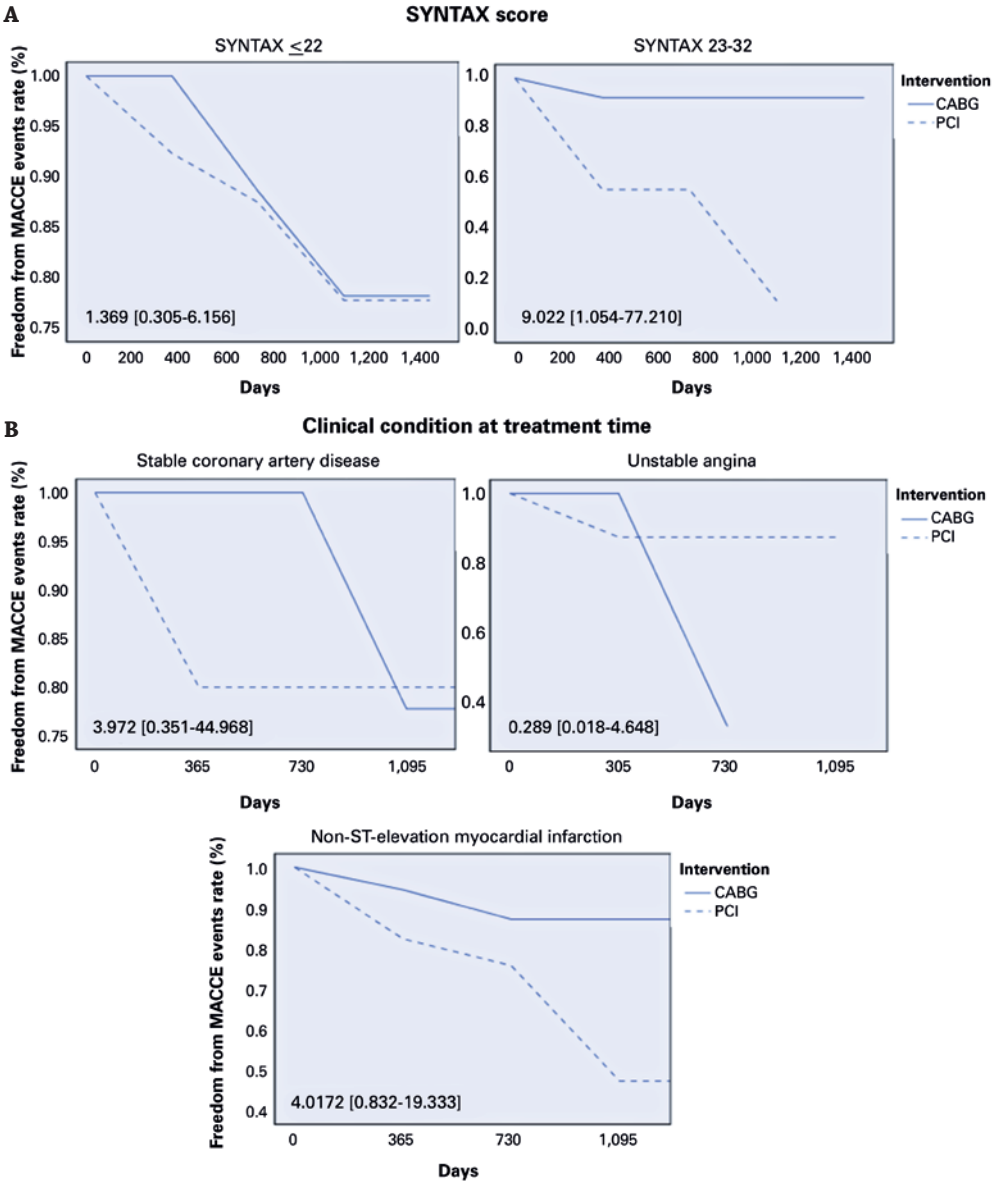
Event	CABG Group (n=36)	PCI Group (n=36)	Coefficients PCI *versus* CABG	Standard error	Hazard ratio (95%CI)	p-value
MACCE	6 (17.14)	13 (37.14)	1.024	0.592	2.786 (0.873-8.889)	0.084
All causes of death	4 (11.43)	9 (25.71)	0.927	0.61	2.526 (0.777-8.209)	0.123
Cardiovascular death	2 (5.71)	2 (5.71)	0.069	1.001	1.071 (0.151-7.612)	0.945
Stroke	2 (5.71)	0	*	*	*	*
Myocardial infarction	0	2 (5.71)	*	*	*	
Revascularization	0	1 (2.86)	*	*	*	*
Stent /graft occlusion	0	1 (2.86)	*	*	*	*
PCI	0	1 (2.86)	*	*	*	*
CABG	0	0	*	*	*	*
Hospital admission, due to cardiac symptoms	18 (25.00)	6 (16.67)	-0.259	0.472	0.772 (0.306-1.947)	0.583

Results expressed as n (%), if not indicated in another way.
* We could not apply our statistical tests to many of our secondary endpoints because one of the groups did not report any event.
CABG: coronary artery bypass grafting; PCI: percutaneous coronary intervention; MACCE: major adverse cardiac and cerebrovascular events.



MACCE: major adverse *cardiac* and cerebrovascular events; CABG: coronary artery bypass grafting; PCI: percutaneous coronary intervention.

Figure 1. Kaplan-Meier curves for 3-years post-treatment outcomes for the propensity-matched patients, who underwent coronary artery bypass grafting or percutaneous coronary intervention. (A) All major adverse cardiac and cerebrovascular events; (B) all death causes; (C) cardiovascular death; (D) stroke; (E) myocardial infarction; (F) stent/graft failure; (G) hospital admission. Cumulative event survival rates are from Kaplan-Meier and log-rank statistics analysis. P-values are from univariate Cox regression analysis.



MACCE: major adverse cardiac and cerebrovascular events; CABG: coronary artery bypass grafting; PCI: percutaneous coronary intervention.
Figure 2. Kaplan-Meier curves for 3-years post-treatment outcomes for the propensity-matched patients, who underwent coronary artery bypass grafting or percutaneous coronary intervention, stratified by baseline anatomic complexity (A) and clinical condition (B).

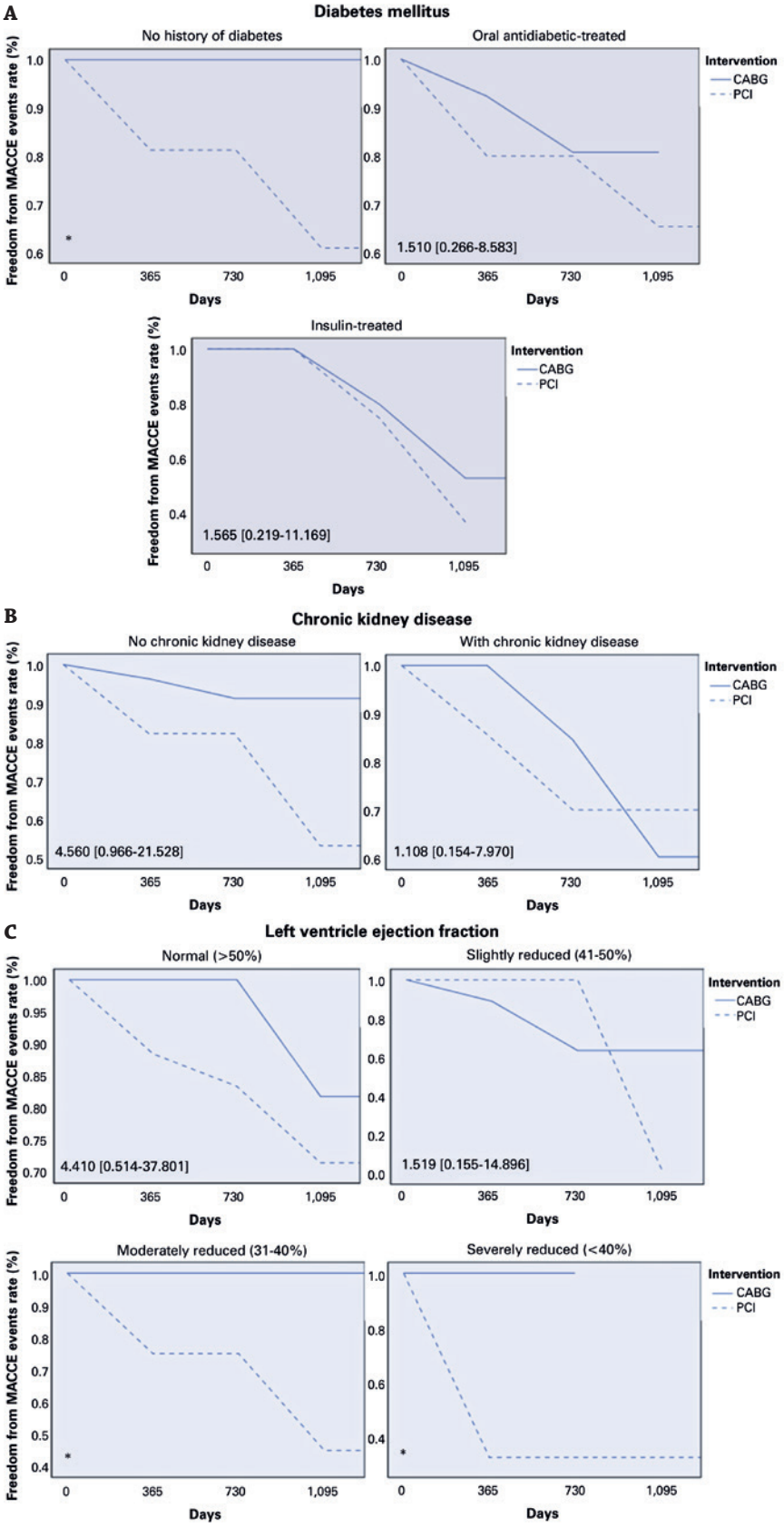
During the 3-year follow-up, cardiac-related hospital admissions were more frequent in the CABG Group (18; 25% *versus* 6; 16.67% in the PCI Group), but occurred more acutely in the PCI Group, even though no significant differences were found.

Stroke happened more frequently in the CABG Group, with a total of two cases reported, whereas in the PCI Group there was none. Myocardial infarction rate was higher in the PCI Group (2; 5.71%) and one happened in the first 30 days. Revascularization due to restenosis had only one case registered, in the PCI Group and the patient was submitted to a second PCI.

After 3-year follow-up, we were able to collect data from 15 patients in the CABG Group, with the longest follow-up being 4 years and 10 months, as well as from nine patients in the PCI Group, with the longest follow-up being 3 years and 7 months.

Other secondary endpoints

The relative treatment effect for the primary endpoint within prespecified subgroups is exposed in the Kaplan-Meier curves, in figure 3. By and large, CABG and PCI behaved the same in the subgroups, with no statistical differences found between them.



MACCE: major adverse cardiac and cerebrovascular events; CABG: coronary artery bypass grafting; PCI: percutaneous coronary intervention.

Figure 3. Kaplan-Meier curves for 3-years post-treatment outcomes for the propensity-matched patients, who underwent coronary artery bypass grafting or percutaneous coronary intervention , stratified by baseline comorbidities.

DISCUSSION

In this retrospective and observational study, in the group of patients with left main coronary disease, PCI was non-inferior to CABG with respect to the primary endpoint of major adverse cardiac and cerebrovascular events at one and three years. In the whole sample, rates of primary and secondary endpoint events were higher in the PCI Group, except for stroke and hospital admission, which were more frequent for the CABG-treated patients.

As to outcomes, we see a tendency for occurrence of events sooner in the PCI Group that in the CABG Group, with the rate of the composite endpoint of death, stroke, myocardial infarction or revascularization within 30 days after treatment higher in the PCI subjects, due to the cardiac-related death and myocardial infarction recordings, accounting for all events taking place within 30 days (*versus* no events registered in the CABG Group). Between 30 days and 3 years after the procedure, events in the CABG Group start to rise, mostly with a later onset that in the PCI Group. After 3-year follow-up, MACCE stabilized in the PCI Group, with few events registered, but kept raising in the CABG Group, which make us conclude that CABG seems to have a later onset of events.

Data interpretation needs to take in account the fact the event frequency is low, individual components of the outcomes are even lower, which makes that in some cases, such as stroke, myocardial infarction, restenosis, and revascularization, one of the groups did not have any events, so it was not possible to make our statistical analysis comparisons in these cases. This can be attributed to the small size of our sample and to the subsequently low number of events that we acquired in general. In addition, for some of our results, even though it was possible to apply our statistical tests, their analysis shows confidence intervals too wide, and associated with considerable standard errors, as we can see for the one-year outcomes, and for the 3-year restenosis results. Hence, despite no statistical significance was found for these two groups, results should be interpreted with caution. Another fact that we need to consider is that we could not find completely similar samples after the propensity score matches, namely regarding the known coronary disease or with previous angioplasty performed. For the age variable, no statistical differences were found between PCI and CABG, which lead to the conclusion that age may not have a major impact on the results. However, as in the other sets of analysis, caution must be taken when interpreting the findings, because of low number of events, especially in the under 70-year-old group.

Although it was not possible to draw conclusions from our statistical tests for some endpoints, our results are similar to those described in the currently available literature.[16] Nonetheless, our findings do not corroborate the assumptions of the current ESC/EACTS guidelines[8] on myocardial revascularization regarding diabetic patients, which state CABG is more suitable for them than PCI. In fact, we obtained equivalent outcomes for both treatments, regardless of the therapeutic plan, which is in line with the results found by other studies, such as SYNTAX[31] and the more recent EXCEL trial,[15] except for the higher repeat revascularization rates they obtained for the PCI arm. The composite endpoint of death, stroke, myocardial infarction, and revascularization is not unanimous throughout conducted studies. While we have observed no difference at 3-year follow-up, which agrees with EXCEL[15] findings, the NOBLE trial[16] had a 5-year follow-up and concluded CABG showed superiority.

CONCLUSION

Our results suggest that percutaneous coronary intervention is an acceptable alternative to coronary artery bypass grafting for patients with stable left main coronary artery disease, except for those with high anatomical complexity, as assessed by imaging tests and, for which better outcomes were obtained in the CABG Group.

This study should be the starting point for further, more substantiated studies, with larger samples and longer follow-ups, to determine whether percutaneous coronary intervention could be non-inferior than coronary artery bypass grafting regarding long-term outcomes, and to assess its reliability within specific subgroups of comorbidities. Furthermore, studies with a greater overlap of sample characteristics should be conducted to eliminate the weight baseline differences of patients may have had in the observed results.

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None.

CONFLICTS OF INTEREST

The authors declare there are no conflicts of interest.

CONTRIBUTION OF AUTHORS

Conception and design of the study: CCO, CGB, JC and JM; data collection: CCO and AJG; data interpretation: CCO, AJG, CGB, JC and JM; text writing: CCO and AJG; approval of the final version to be published: CCO.

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