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Outcomes after coronary artery bypass in aged patients

Desfechos clínicos pós-revascularização do miocárdio no paciente idoso

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Abstract

Objectives: **Analyze the octogenarian patients submitted to coronary artery bypass grafting (CABG) with and without cardiopulmonary bypass (CPB) comparing the clinical outcomes and survival curves.**

Methods: **Observational study of the cohort type involving 396 octogenarians submitted to CABG between 01/01/2000 and 01/01/2007. Elaboration of an itinerary for collection of data of the handbooks containing 36 variables. Comparison between groups using the t test for independent samples, chi-square and survival curves using Kaplan Meier.**

Results: **We analyzed 290 patients that possessed appropriate information. The first group G1, of the patients operated without CPB consisted of 111 patients and the second group G2, of the operated ones with CPB consisted of 179 patients. The univariated analysis presented statistics significance for the variables: cardiac insufficiency functional class preoperative (*P*=0.000), tobacco smoking (*P*=0.050), number of performed grafts (*P*=0.050), graft type (*P*=0.000), associated procedures (*P*=0.000), preoperative use of intra-aortic balloon (*P*=0.000), hospital mortality (*P*=0.000) and type of death (*P*=0.020). In the postoperative outcomes it was significant only the incidence of brain stroke (CVA) in G2 (*P*=0.036). In the long term there was higher incidence of re-internment for angina (*P*=0,038). The analysis of the survival curves presented statistic difference (*P*=0.009; *Log-Rank Test*).**

Conclusions: **CABG without CPB, in this series, proved to be beneficial for the octogenarian patients in the short term, due to the patients having presented lower incidence of brain stroke in the immediate postoperative, whereas in the long term there was higher incidence of re-internments for angina in G1 and higher prevalence of cardiac deaths in G2.**

Descriptors: **Coronary artery bypass. Coronary artery bypass, off-pump. Coronary disease. Aged, 80 and over.**

Resumo

Objetivo: **Comparar os desfechos clínicos nos pacientes octogenários submetidos à revascularização cirúrgica do miocárdio com e sem a utilização de circulação extracorpórea.**

Métodos: **Estudo de coorte histórico com pacientes octogenários operados no InCor no período entre 1/1/2000 e 1/1/2007, divididos em dois grupos: G1 constituído por 111 pacientes operados sem circulação extracorpórea (CEC) e G2 com 179 operados com CEC. Foram analisadas 36 variáveis utilizando-se o teste t de Student, qui quadrado e as curvas de sobrevida pelo método de Kaplan-Meier; Nível de significância de 5%.**

Resultados: **Na análise univariada apresentaram significância: insuficiência cardíaca congestiva pré-operatória (*P*=0,000), tabagismo (*P*=0,050), número de enxertos realizados (*P*=0,050), tipo de enxerto (*P*=0,000), procedimentos associados (*P*=0,000), uso de balão intra-aórtico no pós-operatório (*P*=0,000), óbito hospitalar (*P*=0,000) e tipo de morte (*P*=0,020). No pós-operatório imediato, foi significativa apenas a incidência de acidente**

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vascular cerebral (AVC) no G2 (*P* = 0,036). A longo prazo tivemos maior incidência de reinternação por angina (*P*=0,038) no G1. A análise das curvas de sobrevida apresentou diferença estatística (*P*=0,009; *Log-Rank Test*).

***Conclusão:* A revascularização do miocárdio sem CEC, nesta série, mostrou ser vantajosa para o paciente octogenário a curto prazo, pois os pacientes apresentaram menor índice de AVC no pós-operatório mediato, enquanto a longo prazo houve maior número de reinternação por angina no G1 e uma mortalidade maior no G2.**

***Descritores:* Ponte de artéria coronária. Ponte de artéria coronária sem circulação extracorpórea. Doença das coronárias. Idoso de 80 anos ou mais.**

INTRODUCTION

Despite the use of cardiopulmonary bypass (CPB) being considered the gold standard in coronary artery bypass grafting (CABG) for decades, there is a growing enthusiasm for CABG without CPB.

Comparative studies using these two methods showed that both present similar results regarding the improved quality of life [1-4] and the patency of the graft [2,3,5], while several studies have shown some advantages without the use of CPB as lower risk of stroke (CVA), decreased incidence of atrial fibrillation and surgical wound infections [6].

Regarding the possibility of incomplete CABG due to smaller number of grafts per patient, performed without cardiopulmonary bypass [6], Magee et al. [7] showed that this difference relates more to the choice of patients requiring fewer grafts for surgery without CPB.

The primary objective of the study was the comparative analysis of the clinical outcomes of short, medium and long term following the CABG, with and without the use of CPB in octogenarian patients and its influence on morbidity and mortality. Secondly, comparing the survival curves of different samples of study.

METHODS

This is an observational study of non-concurrent cohort type involving octogenarian patients who underwent CABG at the InCor-FMUSP, in the period of 01/01/2000 to 01/01/2007. During this period, there were 27,863 cardiac surgeries, of which 8,765 were related to the treatment of coronary artery disease, being that of this amount, 396 patients were 80 years or more. The research was conducted by examining the medical records of patients, and due to lack of data, incomplete or inconsistent notes, we dropped 106 cases, leaving the sample with only 290 patients. Still, in some cases, there was insufficient data to prove whether or not the variable existed, being necessary to calculate the percentage applied to such situations. Statistical analysis comparing the two groups was performed using the t test for independent samples with significance level of five percent ($P \leq 0.050$) and the analysis of survival curves by the Kaplan-Meier method. The project was supported by FAPESP and was previously approved by the Ethics Committee of the Institution.

Patients were stratified into two groups, respectively operated with CPB (G1) and without CPB (G2) (Table 1). G1 patients were revascularized using mild hypothermia and myocardial protection with anterograde blood cardioplegia, and in the G2 group, the operation was performed with the aid of a stabilizer, with the number of grafts per patient equivalent (2.31 ± 0.81 and 2.51 ± 0.90, respectively, $P = 0.058$).

Table 1. Demographic distribution.

Variable	G1(with CPB)	G2 (without CPB)	*P* Value
Number	111	179	
Gender			
Male	44	82	0.304
Female	67	97	0.304
Age (years)	82.19 ± 3.48	82.44 ± 2.40	0.477
Weight (kg)	69.03 ± 11.27	65.09± 10.43	0.004*
Height (m)	1.63 ± 0.09	1.60 ± 0.09	0.038*
BMI	25.91 ± 3.81	25.28 ± 3.56	0.184

** - significant; CPB – cardiopulmonary bypass; BMI – body mass index*

The on-pump group consisted of 111 patients, of whom 60% were male and G2 with 46% of 179 female patients, the age was 82.19 ± 3.48 years for G1 and 82.44 ± 2.4 years for G2, the G1 group had an average weight (69.03 kg ± 11.27) greater than the on-pump group (65.09 ± 10.43 kg), with statistical significance ($P = 0.004$), as it was in relation to height, which was also higher in G1 (1.63 ± 0.09 m *versus* 1.60 ± 0.09 m), with $P = 0.038$. But when confronting the body mass index (BMI) we noted no significant statistical differences (25.91 ± 3.81 *versus* 25.28 ± 3.56, $P = 0.184$).

In relation to the preoperative clinical condition (Table 2), the groups were mainly about the presence of heart failure functional class III/IV in the CPB group (18.4% *versus* 35.9%, $P = 0.005$) showing tendency to indicate this method in cases with poor ventricular function, regarding the presence of previous acute myocardial infarction (AMI),

the proportion was similar in both groups (29.6% *versus* 40.1%, *P* = 0.074) and also without statistical significance, of patients with AMI less than 6 months of operation.

Another difference between the groups was the lowest number of grafts per patient in those who did not use CPB (2.31 ± 0.81 *versus* 2.51 ± 0.91, *P* = 0.058), although both groups had mean of coronary arteries lesion with no statistical difference (2.42 ± 0.73 *versus* 2.69 ± 0.91, respectively, *P* = 0.076). There was no difference between the groups regarding the type of graft used in the operation and on the character of the operation (Table 3).

RESULTS

In the period of mediate postoperative (hospital), we had similar incidence and non significant of respiratory care for more than 24 hours of AMI, the onset of renal impairment (serum creatinine exceeding 2 mg / dl). The same occurred when analyzing the need for reoperation and the appearance of surgical site infection, in contrast, by studying the presence of stroke after the CABG, we noted a higher incidence in patients who underwent the use of CPB (*P* = 0.036).

Table 2. Preoperative clinical situation.

Variable	G1(without CPB)			G2(with CPB)			*P* Value
	N	N1	% Valid	N	N1	% Valid	
Angina	80	6	46.7 %	130	10	52.1 %	0.646
Preoperative CHF (FC III / IV)	16	24	18.4 %	51	37	35.9 %	0.005*
Previous AMI	32	3	29.6 %	71	2	40.1	0.074
Interval between AMI and the operation	9	83	32.1 %	52	113	21.2 %	0.264
Diabetes	47	5	44.3 %	63	3	35.8 %	0.155
COPD	8	6	7.6 %	13	3	7.4 %	0.943
Smoking	19	6	17.8 %	49	2	27.7%	0.058
Dyslipidemia	51	6	48.6%	89	7	51.7%	0.610
Hypertension (BP> 140/90)	47	9	46.1%	64	12	38.3%	0.211
Previous stroke	4	2	3.7%	9	4	5.1%	0.565
Ejection fraction LV (> 50 %)	41	48	65.1%	68		56.2%	0.247
Creatinine (> 2 mg/dl)	7	38	9.6%	9	59	7.5%	0.612
Previous thrombolysis	1	3	0.9%	4	4	2.3%	0.401
Previous angioplasty	20	2	18.3%	24	3	13.6%	0.286
Previous stent	10	2	9.2%	14	3	8.0%	0.720
Previous cardiac operations	12	3	11.1%	31	3	17.6%	0.139
Preop IAB	2	6	1.9%	10	10	5.9%	0.115

*N - No. of occurrence; N1 - Number of patients lost according to the variable; * - significant, ** - ≤ 6 months; CHF - congestive heart failure; FC - functional class according to the New York Heart Association, AMI - acute myocardial infarction; COPD - chronic obstructive pulmonary disease; BP-blood pressure; LV - left ventricle; IAB - Intra-aortic balloon*

Table 3. Surgery data.

Variable	G1(without CPB)			G2(with CPB)			Value of *P*
	N	N1	% Valid	N	N1	% Valid	
Character of the							
Elective operation	83	4	77.6%	122	2	68.9%	0.271
Number of compromised arteries	2.42 ± 0.73	-	-	2.69 ± 0.91	-	-	0.076
No. of approached arteries	2.31 ± 0.81	-	-	2.51 ± 0.91	-	-	0.058*
Venous	14		25%	62		58.5%	
Arterial graft type	10	55	17.9%	6	73	5.7%	
Arterial and venous	32		57.1%	38		35.8%	

*N - No. of occurrence; N1 - Number of patients lost according to the variable * - significant*

Table 4. Postoperative evolution.

Variable	G1(without CPB)			G2(with CPB)			*P* Value
	N	N1	% Valid	N	N1	% Valid	
AMI	3	3	2.8%	6	4	3.4%	0.763
Stroke	0	0	0%	7	4	4.0%	0.036*
Respiratory care > 24 h	8	73	21.1%	17	17	27.4%	0.480
Creatinine > 2.0 mg / dl	9	30	11.1%	25	55	20.2%	0.089
IAB	3	7	2.9%	32	12	19.2%	0.000*
Vasoactive drugs (without)	13	18	14.0%	14	26	9.2%	0.242
Reoperation	2	2	1.9%	5	4	2.9%	0.598
Infection	32	3	29.6%	57	17	35.2%	0.322
Rehospitalization for							
Angina	9	4	8.4%	5	15	2.9%	0.038*
CHF	6	5	5.7%	11	7	6.4%	0.805
Stroke	0	4	0.0%	3	5	1.7%	0.173
Arrhythmia	3	4	2.8%	4	5	2.3%	0.793
Death							
Hospital	13	0	11.7%	68	0	38.0%	0.000*
Late	9	0	8.1%	57	0	31.8%	0.000*
Cardiac Type	6	96	40%	44	117	71.0%	0.024*

*N - No. of occurrence; N1 - Number of patients lost according to the variable * - significant; IAB - Intra-aortic balloon*

It was noticed the fact that although both groups had valid percentage of patients who did not require support with similar vasoactive drugs, the same did not occur in relation to the need for hemodynamic support with the use of intra-aortic balloon (IAB), since the G2 group showed a higher frequency in the IAB at the end of the operation and during the immediate postoperative period (19.2% *versus* 2.9%, $P = 0.000$).

The readmissions were for angina, cardiac arrhythmia, CHF and stroke, which were statistically similar, except when the subject was angina, which was more prevalent in the off-pump group, with statistical significance ($P = 0.038$). Also significant was the highest number of deaths, both hospital and later among patients of G2 ($P = 0.000$), deaths from cardiac causes were also prevalent in the group with CPB (Table 4).

DISCUSSION

Sedrakyan et al. [4] argue that the CABG performed without CPB reduces the incidence of stroke compared with conventional CABG, which is consistent with our study because we also observed a smaller percentage of stroke in patients operated without the use of CPB (4% *versus* 0; $P = 0.036$). The fact that G1 patients had higher incidence of stroke in the immediate postoperative period may lead to greater impairment of brain functions and have an impact on the quality of life reported by patients. This observation is consistent with those made by Motallebzadeh et al. [1] and Jensen et al. [3], whereby the qualities of life are better in both groups, without distinction between them.

Unlike Al-Ruzzeh et al. [5] which ensure that patients undergoing CABG have shorter hospital stays than those who did not use CPB, our data showed no statistical difference, with length of stay of 16.90 ± 2.30 days in the off-pump group and 19.36 ± 2.40 days in patients operated without CPB, perhaps because our sample consists only of octogenarian patients.

Another point of disagreement with the findings of Al-Ruzzeh et al. [5] is related to the assertion that the patency of the grafts, which was similar in patients in both groups. Although we have not restudied patients to assess the patency of the grafts, we observed the greatest number of re-admissions for angina in patients who did not use CPB ($P = 0.038$) and this fact may have been determined by the lower patency of the grafts, being less likely that the difference is caused only by the development of coronary atheromatosis in that particular group.

Regarding the statements made by Pereira et al. [8], that in randomized studies the doctor works as an important predictor of outcomes, we can say that, although our study is of cohort, in our study; outcomes like myocardial infarction, renal dysfunction and postoperative infection were not altered by the medical professional and did not

reach clinical differences and statistical significance.

We agree with Romeo-Corral et al. [9] to argue that the body mass index does not have decisive power to predict the clinical outcomes between the groups studied. In our series, we found no clinical and statistical difference between groups (25.28 ± 3.81 *versus* 25.28 ± 3.56, *P* = 0.184), although several outcomes have shown clinical differences and statistical significance, especially stroke in the immediate postoperative period (*P* = 0.036) and hospital mortality (*P* = 0.000). It is worth noting that the G1 group had higher mean body weight (69.03 ± 11.27 *versus* 65.09 ± 10.43, *P* = 0.004) and even then it was the one that exhibited a lower rate of hospital mortality.

In our observation, only 14% of G1 patients and 9% of G2 had need of vasoactive drugs in the immediate postoperative period (*P* = 0.242), which is consistent with Tatoulis et al. [10] when they stated that both groups need little support of vasoactive drugs.

Among the long-term results we have identified a higher rate of re-hospitalization for angina between patients from G1 (8.4% *versus* 2.9%, *P* = 0.038). The most likely explanation for the fact is that in the group of patients revascularized without the use of CPB, the average number of grafts was significantly lower than in G2 (2.31 ± 0.81 *versus* 2.51 ± 0.95; *P* = 0.058). We further noted that the G1 group had lower rate of affected coronary arteries (2.42 ± 0.73 *versus* 2.69 ± 0.91, *P* = 0.076).

With regard to hospital mortality, we can say that it was less in off-pump group (17% *versus* 38%, *P* = 0.000). This observation can be explained by the fact of G2 patients consisting of a larger number of unfavorable factors involved, such as heart failure functional class III / IV (35.9% *versus* 18.4%, *P* = 0.005), required the use of IAB in the preoperative period (5.9% *versus* 1.9%, *P* = 0.115) and in the postoperative (19.2% *versus* 2.9%, *P* = 0.000).

Regarding late deaths, we observed the greatest percentage in the group of patients operated with CPB (31.8% *versus* 8.1%, *P* = 0.000) and these deaths were produced by cardiac causes (71% *versus* 40%, *P* = 0.024).

The analysis of the survival curves showed statistical difference (*P* = 0.009; *Log-Rank test*).

CONCLUSIONS

Based on our samples, we can state that, in elderly patients, if clinical conditions permit, it is best to avoid the use of CPB and, thus, reduce the mortality rate nearly four times (relative risk RR = 3.25; HF 95 % = 1.89 to 5.60). The use of CPB in CABG in the elderly results in higher hospital mortality and a higher prevalence of stroke in the immediate postoperative period. Regarding the results of medium and long term, we found higher rates of re-hospitalization for recurrent angina in the group of elderly patients operated without CPB. In late mortality, the rate was higher in the group operated with CPB, being the predominant cardiac death.

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