

Myocardial revascularization in octogenarian patients: retrospective and comparative study between patients operated on pump and off pump

Revascularização miocárdica em pacientes octogenários: estudo retrospectivo e comparativo entre pacientes operados com e sem circulação extracorpórea

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Abstract

Objective: The purpose of the present study is to compare and analyze the benefits of this operation with and without cardiopulmonary bypass in octogenarian patients.

Method: Retrospective data of patients aged eighty years or more from December 1995 to December 2003 were analyzed. During this period 73 patients were submitted to coronary artery bypass grafting (CABG), 26 (35.6%) on-pump and 47 (64.4%) off-pump. A comparison was made of the demographic data, preoperative risks, concurrent morbid conditions, types of angina, postoperative complications and surgical outcomes between the on-pump and off-pump groups. The Student t-test was used to compare the groups and the level of significance was set at p-value < 0.05.

Results: Both groups showed a high preoperative risk, although the off-pump group presented less surgical mortality (11.5% vs. 2.1%, p < 0.05). No strokes were observed in the patients operated on off-pump (11.5% vs. 0.0%, p < 0.005). Atrial fibrillation (AF) in the immediate postoperative period was present less often in the off-pump group (30.8% vs. 12.8%, p < 0.005). The postoperative mechanical ventilation time and the presence of respiratory failure were less in the off-

pump group (p < 0.005). The presence of acute renal insufficiency (ARI) was 19.2% in the on-pump group and 0% in the off-pump group (p < 0.05). There was less need for transfusion of blood or blood derivatives in the off-pump group (69.2% vs. 31.9%, p < 0.005). The mean sojourn in the intensive care unit (ICU) was shorter in the off-pump group (p < 0.05). The percentage of patients with no postoperative complications was higher in the off-pump group than in the on-pump group (89.4% vs. 61.5%, p < 0.001).

Conclusions: The present study suggests that patients aged eighty years and over benefit when submitted to off-pump CABG and that this procedure is associated with low rates of postoperative complications such as strokes, AF, ARI and respiratory insufficiency, and with less time in the ICU, a shorter hospital sojourn, less use of blood derivatives and lower mortality. In octogenarian patients off-pump CABG is a safe and effective technique, and may be the operation of choice when correctly indicated.

Descriptors: Myocardial revascularization, aged. Extracorporeal circulation.

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Resumo

Objetivo: O objetivo do presente trabalho é comparar e analisar os benefícios da cirurgia com e sem CEC, em pacientes octogenários.

Método: Foram analisados dados retrospectivos dos pacientes com 80 anos de idade ou mais, no período de dezembro 1995 a dezembro de 2003. Neste período, 73 pacientes foram submetidos à revascularização do miocárdio (RM), sendo 26 (35,6%) com CEC e 47 (64,4%), sem CEC. Os dados demográficos, fatores de risco pré-operatório, comorbidades, classe da angina (CCVS), complicações pós-operatórias e resultados cirúrgicos foram comparados entre os dois grupos (com CEC e sem CEC). Utilizou-se o teste de “t de Student” na comparação entre os grupos e foi considerado um nível de significância de $p < 0,05$.

Resultados: Ambos os grupos apresentaram maior risco pré-operatório, embora o grupo sem CEC tenha exibido menor mortalidade cirúrgica (11,5% x 2,1%, $p < 0,05$). Não foi observado acidente vascular cerebral (AVC) nos pacientes operados sem CEC (11,5% x 0,0% $p < 0,005$). Foi menor a presença de nova fibrilação atrial (FA), no pós-operatório imediato, no grupo operado sem CEC (30,8% x 12,8% $p < 0,005$). O tempo de ventilação mecânica, no pós-operatório,

e a presença de insuficiência respiratória foram menores no grupo sem CEC ($p < 0,001$). Presença de insuficiência renal aguda (IRA) foi de 19,2% nos pacientes operados com CEC e nula nos operados sem CEC ($p < 0,05$). Necessidade de transfusão de sangue ou hemoderivados foi menor no grupo sem CEC (69,2% x 31,9%, $p < 0,005$). O tempo médio de permanência na UTI e hospitalar foi menor no grupo sem CEC ($p < 0,05$). Nos pacientes livres de complicações no pós-operatório, o grupo sem CEC foi maior 89,4% x 61,5% nos pacientes operados com CEC ($p < 0,001$).

Conclusões: O presente estudo sugere que pacientes com 80 anos ou mais de idade se beneficiam quando submetidos à cirurgia de RM sem CEC, e este procedimento está associado a baixas taxas de complicações pós-operatórias: AVC, FA, IRA e insuficiência respiratória, bem como menor tempo de UTI e de permanência hospitalar, menor uso de hemoderivados e menor mortalidade. Em pacientes octogenários, a cirurgia de RM sem CEC é uma técnica segura e eficaz, podendo ser a operação de escolha, quando aplicada com a devida indicação.

Descritores: Revascularização miocárdica, idoso. Circulação Extracorpórea.

INTRODUCTION

Great advances and improvements in the operative techniques of cardiopulmonary bypasses (CPB) have significantly contributed to decreasing the morbidity and mortality rates in coronary artery bypass grafting (CABG). This surgery, when it is performed in old patients, is associated with a greater morbid-mortality rate compared to younger patients and, consequently, it is a significant operative risk. The number of elderly patients has also increased considerably over the last few years, both in developed countries and in countries considered underdeveloped [1,2].

Off-pump CABG has been successfully utilized around the world, mainly, due to a reduction in the surgical risk related to CPB [3-6]. In Brazil, its efficacy has not yet been established in old patients, particularly in over 80-year-olds. In the present study, the authors retrospectively analyzed the in hospital and immediate postoperative results in over 80-year-old patients who underwent on-pump and off-pump CABG.

METHOD

From December 1995 to December 2003, 2,398 patients were submitted to CABG alone in the Oswaldo Cruz University Hospital – FCM, Real Hospital do Coração – RHP (Recife, PE) and in the Natal Hospital Center (Natal, RN). Among these, 73 over 80-year-old patients were submitted to on-pump or off-pump CABG. The patients were

divided into two groups 26 (35.6%) used CPB and 47 (64.4%) did not use CPB. The clinical-surgical indication of the surgeon involved was the criterion used to include the patient in either of the two groups. In the on-pump group 14 (53.8%) were men, with a mean age of 82.8 years and in the off-pump group 28 (59.6%) were men, with a mean age of 85.7 years. The preoperative data were retrospectively reviewed and the data collected were age, gender, mellitus diabetes, obesity, renal insufficiency, history of heart failure, class of heart failure according to the NYHA classification at the time of the surgery, previous acute myocardial infarction, previous strokes, obstructive pulmonary disease, calcification of the aorta, atrial fibrillation, angina classification, ejection fraction of less than 30%, angiographic results, reoperations, emergency surgery, surgical data, postoperative complications and mortality.

The patients who underwent on-pump CABG followed the conventional surgery, medium sternotomy, CPB established with cannulation of the ascending aorta and right atrium, hypothermia at 28°C, isothermal sanguineous antegrade cardioplegia followed by the distal anastomoses. The proximal anastomoses were made using partial aortic clamping with the heart beating. In patients who underwent off-pump CABG, the technique previously described by us was utilized [5], with medium sternotomy, placement of a suture in the posterior pericardium, mechanical stabilization of the pressure and utilization of intracoronary shunt, achieving the distal anastomosis followed by the proximal with the use of partial aortic clamping.

The statistical analysis was made using the Student t-test to compare the groups and a p-value <0.05 was considered significant.

RESULTS

The preoperative data of each group are shown in Table 1. The preoperative risk factors (age, sex, mellitus diabetes, obesity, renal insufficiency, history of heart failure, previous acute myocardial infarction (AMI), previous stroke, chronic obstructive pulmonary disease, calcification of the aorta, atrial fibrillation and ejection fraction of less than 30% and coronary vessel diseases) were equally distributed between the groups (non-significant). Patients with Functional Class II according to the NYHA criteria or Class I angina according to the CCVS criteria were more frequency treated using the off-pump procedure (p<0.05).

The operative data are shown in Table 2. Deaths and reoperations were not seen in the group of the patients who

underwent off-pump surgeries. The other operative factors (total number of grafts, number of grafts per patient, type of graft used and surgery type) was similar between the groups (non-significant). One (3.8%) death was observed in the on-pump group, however without giving any statistical difference.

The postoperative results can be observed in Table 3. Strokes were seen only in the on-pump group (12% - p-value < 0.005). Atrial fibrillation was present in 32.0% of the cases in the on-pump group and 12.8% of the cases in the off-pump group (p<0.005). Respiratory failure was more frequent in the on-pump group (16%) when compared to the off-pump group (2.1% - p-value < 0.001). In the off-pump group, renal insufficiency which required dialysis was not observed in the postoperative period, whilst in the on-pump group 20% of the patients required dialysis (p<0.05). Mechanical ventilation of more than 24 hours was more frequently observed in patients of the on-pump group (24%) than of the off-pump group (4.3% - p-value < 0.001).

Table 1. Pre-operative risks of over 80-year-old patients submitted to on-pump and off-pump coronary artery bypass grafting

		On-pump number	%	Off-pump number	%	p
Total number		26	35.6	47	64.4	
Mean age		82.4		85.7		NS
male		14	53.8	28	59.6	NS
female		12	46.2	19	40.4	NS
Diabetic		8	30.8	18	38.3	NS
Obese		1	3.8	3	6.4	NS
Renal insufficiency		0	0.0	0	0.0	NS
NYHA						
	Class I	19	73.1	37	78.7	NS
	Class II	7	26.9	8	17.0	0.05
	Class III	0	0.0	1	2.1	NS
	Class IV	0	0.0	1	2.1	NS
Acute myocardial infarction		1	3.8	0	0.0	NS
Previous acute myocardial infarction		16	61.5	28	59.6	NS
Previous stroke		3	11.5	4	8.5	NS
Chronic obstructive pulmonary disease		2	7.7	8	17.0	NS
Calcification of aorta		1	3.8	3	6.4	NS
atrial fibrillation		3	11.5	4	8.5	NS
Class of angina (CCVS)						
	I	1	3.8	3	6.4	0.05
	II	1	3.8	2	4.3	NS
	III	8	30.8	13	27.7	NS
	IV	16	61.5	29	61.7	NS
Ejection fraction < 30%		2	7.7	3	6.4	NS
Involved vessels						
	DA	24	92.3	45	95.7	NS
	CD	8	30.8	16	34.0	NS
	DI	4	15.4	8	17.0	NS
	MG	9	34.6	14	29.8	NS

NYHA: New York Heart Association; CCVS: Canadian Cardiovascular Society

Table 2. Operative factors of over 80-year-old patients submitted to on-pump and off-pump coronary artery bypass grafting

	On-pump number	%	Off-pump number	%	p
Total number	26	35.6	47	64.4	
Reoperation	2	7.7	0	0.0	NS
Grafts					
Total	60		89		
Mean number of grafts per patient	2.3		1.9		NS
Type of graft used					
Internal thoracic artery	19	73.1	42	89.4	NS
Saphenous vein	24	92.3	39	83.0	NS
Type of surgery					
Elective	13	50.0	25	53.2	NS
Urgency	10	38.5	17	36.2	NS
Emergency	3	11.5	5	10.6	NS
Operative mortality	1	3.8	0	0.0	NS

Table 3. Post-operative results of over 80-year-old patients submitted to on-pump and off-pump coronary artery bypass grafting

	On-pump number	%	Off-pump number	%	p
Total number	25	34.7	47	65.3	
Stroke	3	12.0	0	0.0	<0.005
New atrial fibrillation	8	32.0	6	12.8	<0.005
Respiratory insufficiency	4	16.0	1	2.1	<0.001
Renal insufficiency requiring dialysis	5	20.0	0	0.0	<0.05
Ventilation time > 24 hours	6	24.0	2	4.3	<0.001
Blood and derivative transfusions	18	72.0	15	31.9	<0.005
Mean UTI time (hours)	63		39		<0.05
Mean hospitalization (days)	14		9		<0.05
Acute myocardial infarction	2	8.0	2	4.3	NS
Bleeding	2	8.0	0	0.0	NS
Sternum infection	2	8.0	0	0.0	NS
Sepsis	0	0.0	0	0.0	NS
Mortality	3	12.0	1	2.1	<0.05
Free of complications	16	64.0	42	89.4	<0.001

The use of blood and derivatives was greater in the on-pump group (72.0%) compared to the off-pump group (31.9% - p-value < 0.005). The mean ICU and the hospitalization stays were shorter with patients in the off-pump group (p-value < 0.05). Statistical difference was not observed between the two groups in respect to acute myocardial infarction, bleeding or infection of the sternum. The mortality rate in the off-pump group was low (2.1%) and the mortality in the on-pump group was 12.0% (p-value < 0.05). In the on-pump group, 64% of the patients remained free of complications, while in the off-pump group 89.4% of the patients remained free of complications (p<0.001).

COMMENTS

CABG surgery in over 80-year-old patients is an important concern, mainly as the surgery is associated to a high risk of morbid-mortality. Generally, over 80-year-old patients present a higher surgical risk due to more advanced atherosclerosis and are more susceptible to pulmonary, renal, neurologic and specifically neuro-cognitive complications [7]. The surgical indication in over 80-year-old patients aims principally at relieving symptoms and improving the quality of life, as the long-term result can be affected by the appearance of diseases in other organs related to aging [3].

CABG surgery is associated with a series of risks inherent to CPB such as: the handling of the aorta during cannulation resulting in embolia followed by stroke; a change of the type of cerebral flow during CPB; hemodilution causing anemia and fluid retention; prolonged CPB time which generally is very damaging for elderly patients [7,8]. When CABG surgery is performed, the aforementioned risks disappear and in a first analysis, this procedure seems to be the best choice for over 80-year-old patients [9].

The low mortality of the off-pump patients (2.1%) compared to the on-pump patients (12%) is very evident in the current study. In spite of new advances in the pre-, peri- and post-operative periods, mortality continues to be high in patients considered elderly, particularly in the over 80-year-old group [10]. In a review of 1399 over 70-year-old patients submitted to on-pump CABG, HE et al. [11] demonstrated a mortality rate of 8.8% and morbidity of up to 53.8%. CRAVER et al. [10] also presented a mortality rate of 8.2% in elderly patients submitted to elective surgery. But when these patients were operated on with urgency the mortality rate increased to 24.1%. Similar results were reported by FREEMAN et al. [12], with a mortality rate of 5.6% in elective surgeries and 23% in urgent surgeries. HIROSE et al. [3] did not observe any significant differences in the mortality of elderly patients (mean age of 78 years) submitted to on-pump and off-pump surgeries. The mortality rate observed by HOFF et al. [13] was 4.7% among patients submitted to on-pump surgeries and none in the off-pump group, although this difference was not considered significant.

Strokes are one of the most harmful complications in the postoperative period of CABG surgery. Generally this is unexpected but several factors can contribute to triggering this event. It is known that CPB in itself is responsible for many strokes. In the current work, an incidence of strokes of 12% was seen in patients submitted to on-pump surgery and not one case in those operated off-pump ($p < 0.005$). RICCI et al. [2] obtained a similar result in elderly patients and reported strokes in 9.3% of the patients operated on-pump ($n = 172$) and not one case in patients operated off-pump ($n = 97$) ($p < 0.005$). HOFF et al. [13], studying an over 80-year-old population submitted to on-pump and off-pump CABG surgery, observed rates of 7.1% x 0% (p -value < 0.04). The mortality expected by the National Society of Thoracic Surgeons - Cardiac Surgery Database Risk Model for CABG was of 3.8% (p -value < 0.001), TREHAN et al. [14] observed a rate of 0.14% for strokes and transitory ischemic attacks and a mortality rate due to strokes of 0.07%. In a recent metanalysis, ATHANASIOU et al. [15] suggested that less invasive procedures used in patients who need to be submitted to CABG surgery, could reduce the neurologic morbidity in a so-called elderly population. The current

experience, supported by published data, suggests a better result for elderly patients submitted to off-pump CABG surgery in respect to strokes, which is considered to be a severe postoperative complication.

Atrial fibrillation in the postoperative period of heart surgery, especially in CABG surgery, is a common finding, sometimes requiring more invasive procedures in its treatment. Patients submitted to on-pump CABG surgery have a 1.8% ($p < 0.03$) higher risk of presenting atrial fibrillation and strokes in the postoperative period, when compared with patients submitted to off-pump surgery [16], even taking into account other risk factors (gender, age, number of grafts, hypertension, history of strokes, carotid artery disease, chronic obstructive pulmonary disease and low ejection fraction). In the current study, only 12% of the patients submitted to off-pump surgeries presented episodes of atrial fibrillation in the postoperative period, however, among the patients submitted to on-pump surgeries the percentage was 32% (p -value < 0.005). These data are important because atrial fibrillation can precede strokes and thus trigger a fatal process.

Renal insufficiency in the postoperative period of patients who required dialysis was 20% in the on-pump group and none in the off-pump group (p -value < 0.05), suggesting that the minimally invasive surgery reduces the incidence of this morbidity [8]. The ventilation time in the postoperative period was significantly less in the patients who were submitted to off-pump surgery (24% vs. 4.3%) (p -value < 0.001), as were the ICU and total hospitalization times. Respiratory insufficiency is directly related to the degree of inflammation in the postoperative period, which is generally caused by CPB. The rate of respiratory insufficiency was one patient (2.1%) in the off-pump group and 16% in those submitted to on-pump surgery ($p < 0.001$). The respiratory insufficiency observed in the patients of the off-pump group was attributed to immediately unrecognized pneumothorax caused by the puncture of the subclavian artery and thus, without any direct relationship to the method employed. It is possible that due to the non-use of CPB these patients evolved with less inflammation and responded similar to patients submitted to simple thoracotomy, making a significant reduction in these variables possible.

The utilization of blood derivatives was also less (72% vs. 31%) in the patients submitted to off-pump surgery (p -value < 0.005). Maybe this number can still be reduced, as there is, in the postoperative period, much care to normalize the hemoglobin levels in this particular group of patients. But, it is necessary to remember that these patients are not submitted to on-pump surgeries and so, they do not suffer hemodilution or any degree of hemolysis during the surgery. Any type of anemia detected in the postoperative period is

generally preexistent anemia or related to the preoperative hydration, which tends to be normalized in the postoperative period [17].

CONCLUSION

Our study demonstrates that off-pump surgery reduces the morbidity and mortality rates in patients submitted to coronary artery bypass grafting surgery in over 80-year-old patients. Apart from the index of complications being much lower in patients submitted to off-pump surgery, the hospital stay was also reduced and 89.4% of the patients of the off-pump group evolved free of complications.

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