EMC

Predictors of mortality in Patients over 70 years-old Undergoing CABG or valve surgery with cardiopulmonary bypass

Preditores de mortalidade em pacientes acima de 70 anos na revascularização miocárdica ou troca valvar com circulação extracorpórea

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Abstract

Objective: To identify risk factors in octogenarians and septuagenarians submitted to cardiovascular surgery with cardiopulmonary bypass (CPB).

Methods: Per-operative variables of 265 Patients over 70 years of age Were analyzed. 248 (93.6%) Were octogenarians and 17 (6.4%) nonagenarians.

Results: Overall mortality did not differ Between the groups, nor did the type of procedure (CABG or valvular) (P = 0545). Pre-operative variables did not Increase the death risk, nor did the use of arterial grafts or venous (*P* = 0261), or the number of grafts per patient (*P* = 0131). CPB and cross-clamp time are Associated with higher mortality. The group Survivors Had An average CPB time of 70 ± 27 minutes while the non-survivors group 88.8 ± 25.4 minutes (*P* <0.001). Cross-clamp time in the survivors was 55.5 ± 20 minutes, while 64.9 ± 16 minutes in the non-survivors (P = 0.014). Using multivariate logistic regression, CPB time is Associated with death (Pearson's χ 2 = 0.0056). CPB time over 75 minutes presents an Increased risk of death of 3.2 times (at 95% CI: 1.3-7.9) over Those With CPB time <75 minutes. Post-operative variables Associated with Increased

death rates: mechanical Ventilation ≥ 12 hours (*P* <0.001), ICU stay (*P* = 0.033), re-exploration (*P* = 0.001), inotropic support> 48 hours (*P* <0.001), use of blood components (*P* <0.001).

Conclusion: Overall mortality justifier of the interventions. CPB time 75 minutes Greater Than, mechanical Ventilation over 12 hours, length of ICU stay, need for reoperation, inotropic drug support over 48 hours, and use of blood components are Associated with the higher mortality rate.

Descriptors: Aged. Cardiac Surgical Procedures. Myocardial Revascularization. Heart Valves. Risk Factors.

Resumo

Objetivo: Identificar fatores de risco em septuagenários e octogenários submetidos à cirurgia cardiovascular com circulação extracorpórea (CEC).

Métodos: Avaliadas variáveis peri-operatórias de 265 pacientes com mais de 70 anos; desses, 248 (93,6%) eram septuagenários e 17 (6,4%) eram octogenários.

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Resultados: Não houve diferença de mortalidade entre eles, com mortalidade global de 22 (8,3%) pacientes. Não houve diferença em relação ao tipo de procedimento (revascularização ou tratamento valvar) (*P*=0,545). As variáveis pré-operatórias não aumentaram o risco de morte. Enxerto arterial ou venoso (*P*=0,261) e número de enxertos utilizados por paciente (*P*=0,131) não aumentaram a mortalidade. O grupo de sobreviventes apresentou tempo médio de CEC de 70 ± 27 minutos e o grupo óbito, 88,8 ± 25,4 minutos, com significância estatística (*P*<0,001). O tempo de isquemia no grupo de sobreviventes foi de 55,5 ± 20 minutos e no grupo óbito, 64,9 ± 16 minutos, com significância (*P*=0,014). Na regressão logística multivariada, o tempo de CEC é a variável que se associa a morte, com qui-quadrado de Pearson =0,0056. Tempo de CEC > 75 minutos apresenta 3,2 vezes (IC 95%: 1,3 - 7,9), maior chance de óbito do que os pacientes com tempo de CEC ≤ 75 minutos. Variáveis pós-operatórias: tempo de ventilação mecânica ≥ 12 horas (*P*< 0,001), tempo de internação na UTI (*P*=0,033), reoperação (*P*=0,001), suporte inotrópico > 48 horas (*P*<0,001) e necessidade de hemoderivados (*P*<0,001) aumentam a mortalidade.

Conclusão: A mortalidade global justifica a intervenção. CEC > 75 minutos, tempo de ventilação mecânica superior a 12 horas, de internação em UTI, reoperação, suporte inotrópico por período superior a 48 horas e uso de hemoderivados estão associados a maior mortalidade.

Descritores: Idoso. Procedimentos Cirúrgicos Cardíacos. Revascularização Miocárdica. Valvas Cardíacas. Fatores de Risco.

INTRODUCTION

Population aging is a worldwide phenomenon. According to the 2000 census, there was a 35.6% increase in the number of elderly (people over 65 years of age) in Brazil in relation to 1991. Estimates point to the possibility that in the next 20 years, in Brazil, the number of elderly people exceeding 30 million people, and represent almost 13% of the population [1].

Among the causes of death more frequently in the elderly are heart disease, cancer and cerebrovascular disease. According to Beaglehole [2], ischemic heart disease is the leading cause of death in industrialized countries, accounting for 30% of all deaths each year.

In Brazil, in the early 90's, cardiovascular diseases represent the leading cause of death, accounting for approximately 34% of deaths in the country [3]. IBGE figures currently show a life expectancy of around 67.6 years. Demographic data in Brazil and in developed countries show a clear increase of the elderly population. Estimates place in the sixth as the elderly population in the world in 2025 [3].

Considering these data and according to several studies that demonstrate the effectiveness, improved quality of life and increased survival by means of coronary artery bypass grafting [4,5], is experiencing an increase in the indication of surgical treatment of coronary artery disease and degenerative valve disease in the elderly.

Advances in surgical technique, types of oxygenators, myocardial protection, less invasive surgery, intensive care management and better physical therapy and post-operative help to reduce morbidity and mortality in the elderly [6-7] and is essential to know what are its characteristics individuals to offer an optimal treatment, which determines the success of the procedure [8,9].

Thus, this work aims to identify predictive variables, pre, per and postoperative related to increased morbidity or mortality in patients septuagenarians and octogenarians undergoing CABG or valve replacement using cardiopulmonary bypass.

METHODS

We evaluated 2731 patients undergoing cardiovascular procedures in the Department of Cardiovascular Surgery, Santa Casa de Limeira, SP, Sao Paulo, from January 1998 to January 2009, and 265 (9.7% of total operated) were aged more than 70 years. Of these, 248 (93.6%) were septuagenarian and 17 (6.4%) were octogenarians.

Over 265 patients were evaluated septuagenarian and octogenarian predictive variables before, during and after surgery, to identify which risk factors associated with increased mortality when undergoing artery bypass graft surgery or valve replacement, both using cardiopulmonary bypass.

Chart 1. Criteria for Inclusion

Aged 70 years
Cardiopulmonary bypass
Coronary artery bypass grafting (CABG) or Combined Coronary Artery Bypass (CABG associated) (CABG associated with surgical treatment of cardiac valves, CABG associated with aortic aneurysm repair, CABG associated VSD)
Surgical treatment of cardiac valves (Valve)

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Inclusion criteria were age less than 70 years, use of cardiopulmonary bypass, cardiovascular revascularization procedure (CABG), CABG procedures combined (CABG and heart valve surgery, CABG and aortic aneurysm, RM and VSD after acute myocardial infarction) and heart valve surgery. Exclusion criteria were minimized by aiming at a more comprehensive assessment of these patients (Chart 1). It was used as the sole criterion, patients referred to the operating room in cardiac arrest.

Patients were grouped as follows: patients aged 70 to 79 years (Group septuagenarian) 248 (93.6%) patients and 80 to 89 years (Group Octogenarian) 17 (6.4%). Regarding the type of procedure were grouped into isolated CABG or combined with another procedure (CABG or CABG combined), 223 (84.2%) and surgical treatment of cardiac valves (Valve) 42 (15.8%).

The preoperative variables were assessed occurrence of: acute myocardial infarction (AMI), through enzyme elevation with or without electrocardiographic changes, diabetes mellitus (DM) with fasting glucose $\geq$ 126 mg / dL, hypertension, with systolic pressure level $\geq$ 140 mmHg (hypertension), cerebrovascular accident (CVA), smoking (SMOKE), peripheral vascular disease (DPB), characterized by arterial insufficiency with intermittent claudication, and prior cardiovascular surgery (Reop).

In all cases, the cardioplegia was performed using a solution Buckberg10 amid normothermic blood, with intervals of 20 minutes. Table 1 shows the preoperative variables.

Variables obtained during surgery, assessed the presence and number of arterial and venous grafts, the time of cardiopulmonary bypass and myocardial ischemia time.

The postoperative variables were length of stay in intensive care unit, hospital stay, duration of mechanical ventilation, reoperation for bleeding, need for blood transfusion, postoperative stroke, postoperative confusion and the need inotropic support for more than 48 hours.

Statistical analysis

The various parameters studied were compared by analysis of variance with one factor being broken, the differences between groups by Student t test and the Fisher exact test. For analysis of CPB and ischemia test was used nonparametric Mann-Whitney. We used logistic regression univariate and multivariate analysis. The multivariate model selected by the process variables stepwise. Data are presented as mean, maximum and minimum standard deviation. We established the significance level of 5%.

RESULTS

The overall mortality was 22 (8.3%) patients. There was no difference in mortality between octogenarians and septuagenarians, 20 deaths occurred among 248 (8.0%) patients septuagenarian, and two deaths among 17 (11.7%) octogenarian patients (*P* = 1), Table II. Regarding the type of procedure, it was observed that there was no statistical difference when comparing the MR group associated with MR, with 18 deaths among 206 (8.7%) patients in the MR group versus two deaths among 17 (11.7%) of the patients associated with MRI, and these two were associated with MRI post-infarction VSD. Compared to normal valve, two deaths occurred among 42 (4.7%) patients. Thus, there were 20 deaths out of 223 (8.9%) patients in the RM + RM and two associated deaths among 42 (4.7%) patients in the valve (*P* = 0.545).

Table 2.   Distribution of deaths by age and type of procedure.

	Septuagenarian (n=248)	Octogenarians (n=17)
Isolated MR February	15	2
Associated MR	3	0
Valve	2	0

MR: Myocardial Revascularization

Table 1.   Preoperative variables. N = 265.

Pre-operative variables	Occurences (N=265)	Percent
MI	53	20%
DMII	70	26.4%
SH	170	64.2%
Stroke	5	1.9%
SMOKE	46	17.4%
ISQ	2	0.8%
Reop	8	3%

AMI: acute myocardial infarction; DMII: diabetes mellitus, hypertension, hypertension, stroke, stroke, TOBACCO: Smoking, ISQ: peripheral vascular disease Reop: CABG surgery

Table 3.   Statistical analysis of preoperative variables.

Pre-operative variables	*P*
IAM	0,165
DMII	0,682
HAS	0,381
AVC	1
FUMO	0,387
ISQ	1
Reop	0,136

AMI: acute myocardial infarction; DMII: diabetes mellitus, hypertension, hypertension, stroke, stroke; SMOKING: smoking; ISQ: peripheral vascular disease; Reop: CABG surgery.

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The preoperative variables analyzed did not increase the risk of death in this group of patients (RM, RM and associated Valve). The statistical data are described in Table 3.

Regarding the type of arterial or venous graft, arterial grafts were used 95 and 187 vein in groups MR and associated CABG. We observed an average use of arterial grafts 0.42 per patient and 1.82 venous grafts per patient. There was no increase in mortality when comparing the use of arterial grafts compared to vein grafts ($P = 0.261$). There was no difference in mortality when we evaluated the number of grafts per patient ($P = 0.131$), which ranged from 1 to 5 grafts.

Regarding perioperative variables, we found that the duration of CPB and ischemic times are associated with an increased mortality. The group of survivors had mean CPB time 70 ± 27 minutes in the death group and the mean was 88.8 ± 25.4 minutes with statistical significance ($P < 0.001$).
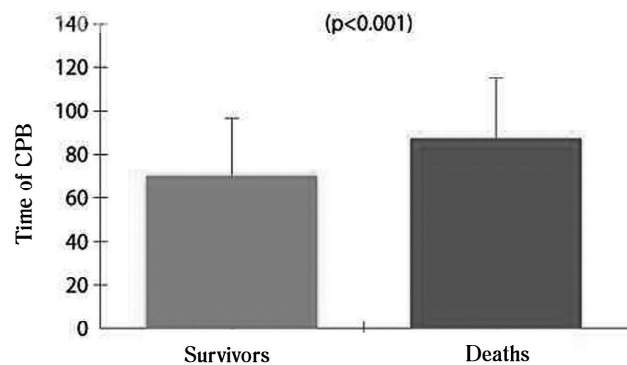

Figure 3 - ROC curve showing the cut-off for the duration of CPB. (CPB> 75 minutes 3.2 times more likely death [95% CI: 1.3 to 7.9]). CPB: Cardiopulmonary Bypass, CI: Confidence Interval

Figure 1 - Time of CPB-related group of survivors and nonsurvivors. CPB: Cardiopulmonary Bypass

The ischemia in survivors was 55.5 ± 20 minutes and in the deceased group, 64.9 ± 16 minutes with significance ($P = 0.014$) (Figure 1).

From this univariate analysis, we used multivariate logistic regression model with duration of CPB and ischemia to evaluate whether the two variables are important determinants of mortality. Significance was not observed. Thus, we used a selection process to identify which one is more important as a determinant of mortality. Where it was observed that the CPB is the variable that is associated with death, with Pearson $\chi 2 = 0.0056$. Figure 2 shows the graph of logistic regression.

We chose to construct an ROC curve for the cut to the CPB time. Through it, we can say that patients with CPB time> 75 minutes have 3.2 times (95% CI: 1.3 - 7.9) greater chance of death than patients presenting with CPB time $\leq$ 75 minutes (Fig. 3).

The postoperative variables were analyzed and showed that the variables length of hospital stay ($P = 0.188$), postoperative stroke 22 (8.3%) patients ($P = 0.230$) and postoperative confusion 22 (8.3%) patients ($P = 0.082$) variables are not predictors of mortality.

The postoperative variables that are related to increased mortality are: duration of mechanical ventilation $\geq$ 12 hours, which occurred in 13 of 22 (59.0%) patients who died ($P < 0.001$), length of stay in unit intensive care unit $\geq$ 48 hours, which occurred in 12 of 22 (54.5%) deaths ($P = 0.033$), reoperation for bleeding in six of 22 (27.2%) deaths ($P = 0.001$); inotropic support for more than 48 hours in 14 of 22

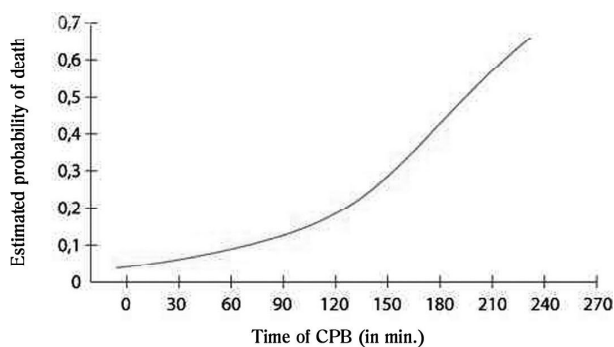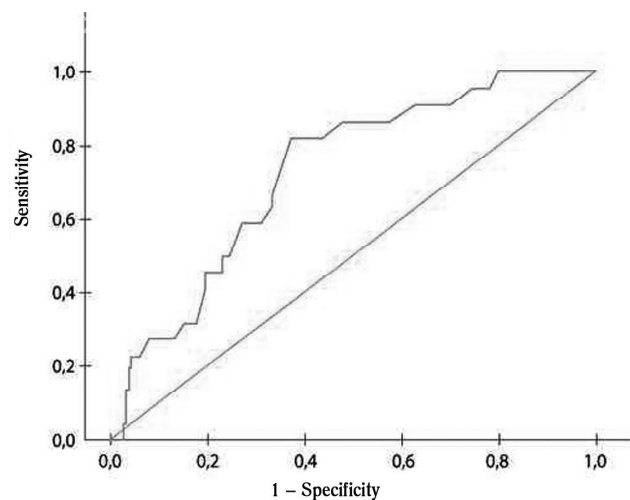*Figure 2 - Graphic logistic regression showing the probability of death in relation to CPB. CPB: Cardiopulmonary Bypass*

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(63.6%) deaths (P <0.001) and need for blood products more than six units of packed red cells or fresh frozen plasma, which occurred in 13 of 22 (59.0%) deaths (P<0.001), as detailed in Table 4.

Regarding the use of blood products, packed red cells was used in 77.7% of patients, fresh frozen plasma in 6.0% of patients and platelet concentrate for 3.3% of cases. The group of survivors received an average of 2.7 ± 1.3 units and the death group received 6.9 ± 13.5 units of blood products.

Table 4. Postoperative variables.

Variables		P
Time of Hospitalization		0.188
Postoperative stroke		0.230
Mental confusion Postoperative		0.082
Ventil time. Mechanical ≥ 12h	13/22 pts (59.0%)	<0.001
Length of Stay in ICU	12/22 pts (54.5%)	0.033
Review of Hemostasis	6/22 pts (27.2%)	0.001
Inotropic support ≥ 48 h	14/22 pts (63.6%)	<0.001
Use of Blood Products (> 06 U)	13/22 pts (59.0%)	<0.001

CVA: cerebrovascular accident, ICU: Intensive Care Unit; pts: patients

DISCUSSION

Increased life expectancy of our population is well documented, with an evident increase in the number of individuals aged over 70 years. Thus, the incidence of cardiovascular disease also increases, which results in our midst, in a high incidence of MI prior to surgery [11]. Once stated the surgical procedure, the added technology and care before, during and after the surgery, lead best outcome for elderly patients who require highly complex cardiovascular intervention, either to improve the quality or life expectancy [12] .

It was noted that work that, in one center in São Paulo, 9.7% of patients operated for 11 years were septuagenarian or octogenarian, translating into a significant portion of total patients. With this fact in mind, we should prepare for the future as they grow in longevity and life expectancy in our population [3]. Surgery in patients over 70 years is feasible and we achieved similar rates of mortality rates of patients undergoing cardiovascular procedures of high complexity in the population above 70 years [13,14], performing all surgeries with cardiopulmonary bypass.

When the guidelines were established in this project, the initial goal was to add the greatest possible number of variables and the smallest possible number of exclusion criteria. The idea was to bring the most of the data obtained

with the daily reality in cardiac surgery. Thus, we used patients undergoing CABG, CABG associated with surgical procedures such as valve replacement, aneurysm of ascending aorta or ventricular septal defect and patients undergoing aortic or mitral valve replacement. Data analysis and grouping of these patients were performed separately. But, analyzing data, there was no difference between them, and we opted for presenting the group as such.

We analyzed preoperative variables, which usually are predictors of poor prognosis, as previous MI, or reoperation. But he noted that these variables did not show differences in mortality in this group of patients [15].

In the past, the use of arterial grafts in patients undergoing emergency situations or for critically ill or the elderly was associated with a worse prognosis, especially in relation to the patency of the graft and wound infection. Tyszka & Fucuda [16] observed that the use of internal thoracic artery brings no increase in morbidity and even improves the early and late survival and should therefore be considered as a graft of first choice for the elderly.

When we evaluated the perioperative variables, it was found that the time of cardiopulmonary bypass and myocardial ischemia time, are associated with increased mortality. This information is important because based on this premise, one can establish an operative strategy that aims at reducing as far as possible from the time of CPB or ischemia. It was noted that a CPB time greater than 75 minutes, increases by 3.2 times the odds of death with a confidence interval ranging from 1.3 to 7.9. The literature shows some parameters related to higher mortality rate in elderly patients, but the time of ischemia and CPB presented as variable multivariate logistic presented in this study has important [17-19].

Regarding postoperative variables, it was observed that the duration of mechanical ventilation longer than 12 hours, the time of ICU stay longer than 5 days, reoperations due to postoperative bleeding, the use of inotropic or vasopressor catecholamines by more than 48 hours and the use of blood products, either red blood cells, fresh frozen plasma or platelet numbers greater than 6 units are linked to increased mortality. These variables had already been demonstrated in other series of cases, and were also highlighted by us [20-22].

Evaluating the aspect of the use of cardiopulmonary bypass, Iglézias et al. [23] observed that the procedures performed with cardiopulmonary bypass are similar to those reported for patients operated without CPB. The incidence of cerebral ischemia and death is the same in groups with or without CPB and not appear as isolated predictors [20]. In line with our data, Angelini et al. [24] reported recently that the long-term results are indifferent to the use of CPB or not.

Limiting factor of our work is the retrospective analysis

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of conventional and electronic medical records. Possibly, some data traditionally found in previously published works, such as preoperative predictors of mortality have not been manifested in our study precisely because of this limitation.

CONCLUSIONS

Septuagenarian and octogenarian patients when undergoing cardiovascular procedures with CPB as a coronary bypass, associated CABG or valve replacement, overall mortality is acceptable. The cardiopulmonary bypass time greater than 75 minutes increases mortality 3.2 times. Postoperative variables such as duration of mechanical ventilation, length of stay in intensive care unit, reoperation for bleeding, prolonged inotropic support and use of blood products is related to increased postoperative mortality.

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