Marcio Roberto Moraes de Carvalho[1], Nelson Albuquerque de Souza e Silva[1], Gláucia Maria Moraes de Oliveira[1], Carlos Henrique Klein[2]

Complications and hospital length of stay in coronary artery bypass graft surgery in public hospitals in Rio de Janeiro

Complicações e tempo de internação na revascularização miocárdica em hospitais públicos no Rio de Janeiro

1. Medical College, Universidade Federal do Rio de Janeiro - UFRJ - Rio de Janeiro (RJ), Brazil.
2. Escola Nacional de Saúde Pública/ Fundação Oswaldo Cruz - Fiocruz – Rio de Janeiro (RJ), Brazil.

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Corresponding author:
Márcio Roberto Moraes de Carvalho
Rua Domingues de Sá, 410
Zip Code: 24220-091 - Niterói - Rio de Janeiro (RJ), Brazil.
Phone: + 55 21 8177-8173 / Fax: + 55 21 2710-9249
E-mail: carvalhobm@uol.com.br

ABSTRACT

Objective: To evaluate associations between post-operative complications in patients who survive surgery and in-hospital deaths and lengths of hospital stays of patients who undergo coronary artery bypass graft surgery

Methods: Patients who underwent coronary artery bypass graft surgery and survived the operating theater were randomly selected. Information on complications and hospital lengths of stay until hospital discharge or death were retrospectively collected based on medical records and declarations of death. These aspects were estimated according to the presence of complications, frequency of complications, mortality, relative risk and attributable population risk. Mean hospital lengths of stay were compared using Wald's statistics.

Results: Medical records indicating deaths in the operating theater were excluded, and 86.9% of the included records reported complications; the greatest loss of information (43.9%) was related to kidney failure. Hyperglycemia was estimated as the most frequent complication (74.6%), with an attributable risk of 31.6%. The population's attributable risks were greater than 60% for low cardiac output (77.0%), kidney failure (64.3%) and cardiorespiratory failure (60.4%). Twelve different situations were identified for paired combinations of significant differences between average post-operative hospitalization times and complications, according to the outcome of discharge or death.

Conclusion: Several complications were identified during the postoperative period of coronary artery bypass graft surgery, with different frequencies and impacts on mortality. Control of the myocardium at the risk of ischemia, hemodynamic stabilization and volume replacement strategies may be effective for controlling mortality rates and shortening hospital lengths of stay.

Keywords: Myocardial revascularization; Cardiac surgical procedures; Length of stay; Mortality; Postoperative complications

INTRODUCTION

Between 1999 and 2003, the in-hospital mortality rate after coronary artery bypass graft surgery (CABG) at four public hospitals in Rio de Janeiro, Brazil, ranged between 7.4% and 14.3%.[1] Of 23 preoperative factors were analyzed, the 7 following factors had significant associations with death: age, arterial hypertension, smoking status, dyslipidemia, stroke and involvement of left coronary trunk associated with obstruction of main coronary systems.[1]

Stoica et al.[2] emphasized that understanding intraoperative complications favors an understanding of adverse outcomes, especially in low-risk patients, thus improving the prediction of the risk of death.

Michalopoulous et al.[3] observed that postoperative morbidity and lengths

of stay was related to patients' ages. They concluded that analysis of preoperative variables might contribute to a better understanding of surgery patients' mortality.

This study aimed to assess the associations between postoperative complications in patients surviving CABG surgery who later died in the hospital and hospital lengths of stay at four public hospitals in Rio de Janeiro, Brazil, between January 1999 and December 2003. We previously published our research on preoperative features' associations with mortality,[1] the use of the EuroSCORE in this population[4] and the association of intraoperative features with time of death within one year of follow-up after surgery.[5]

METHODS

Coronary artery bypass graft (CABG) surgery patients were identified in the city of Rio de Janeiro based on hospital admissions and their corresponding codes. Surgeries performed between January 1999 and December 2003 were included; concomitant valve interventions were excluded. For patients who underwent more than one CABG surgery, the final selection included only the most recent procedure. Overall, 2,692 subjects from the four hospitals in the city of Rio de Janeiro, Brazil, were identified. Two of the hospitals were university hospitals, and two were cardiology reference centers; each pair was constituted by one federal and one state hospital. Thus, the groups were designated A, B, C and D. The sample's selection criteria and the number of CABG patients selected from the four hospitals have been described elsewhere.[1] In summary, we randomly selected 600 medical charts, 150 from each hospital, with different sample mixes in terms of the outcome, i.e., discharge or death, as recorded in the admission documents. Patients who died in the operating room were excluded.

Data from hospital charts were retrospectively searched between 2006 and 2007 by cardiologist investigators, who were trained for data collection using a standardized form that included social and demographic data, hospital admissions information, risk factors or comorbidities, complementary tests, medical prescriptions, surgery conditions, previous angioplasty or CABG, postoperative complications and hospital outcomes. The collected data were transferred into electronic forms using Epidata v. 3.1 software.[6] The variables' definitions and their categorization criteria were provided on sheets for the investigators' instruction and reference. The project was approved by the ethics committee of Hospital Clementino Fraga Filho, Universidade Federal do Rio de Janeiro, under number 102/05.

For this study, variables related to complications, mean length of stay and outcome (discharge or death) were selected. The complications were assessed using the procedure established by Oliveira et al.,[7] and they corresponded to 10 sets, according to the following characteristics: hemodynamic or hemorrhagic; cardiologic ischemic; cardiologic non-ischemic; mechanic; respiratory; metabolic; neurologic; vascular; and multi-organ failure. Data on the outcomes, in-hospital mortality or discharge, were retrieved from the charts. In-hospital death was considered to be death during the hospital stay, confirmed by a declaration of death.[8] The time between the surgery and discharge or death was estimated in days using the difference between the dates of surgery and discharge or death for the patients surviving the operation room.

Statistical analysis

Relative frequencies (percentages) and means were calculated inversely to the selection for sample probability, weighted according to each individual patient, and corrected by the medical charts factor. The weights, according to the patient's hospital and outcome of discharge or death stratum, were: hospital A, survivals: 3.24, deaths 1; hospital B, survivals 15.84, deaths 2.51; hospital C, survivals 4.14, deaths 1.07; and hospital D, survivals 7.41, deaths 1.08.

The relative frequencies of each complication in the patients' sets were estimated, as well as the percentage mortality in the subgroups with/without complications. These percentage differences were tested as population attributable risk (PAR)[9] using weighted chi-squared distribution; values of $p < 0.05$ were considered significant. The relative risks (RR) of death were estimated according to the presence or absence of each complication, with corresponding confidence intervals and PAR[9] calculated for each complication in the patients' sets.

Mean times from surgery until discharge or death were calculated according to the presence/absence of complications and outcomes. The combination of the presence/absence of a given complication and a discharge/death outcome resulted in four means. We tested the differences between the observed means for the following pairs: survival and death without a given complication; survival and death with that complication; survival with and without that complication; non-surviving patients with/without that complication. These mean differences were tested with Wald's statistics

and were weighted, and those differences with $p < 0.05$ were considered significant. Considering the number of complications and the diverse number of observations, we elected to analyze the pairs using $p < 0.01$ denoting statistical significance.

RESULTS

From the originally planned 600 medical charts, 546 were actually collected (91.0%); 22 were excluded due to death during surgery. Of the 524 remaining charts, in 508 (86.9%), information on the analyzed complications was identified. Information loss was more important for metabolic complications. Data on acute renal failure were only found in 294 (56.1%) of the medical charts, on hypoglycemia in 435 (83.0%) of the charts and on hyperkalemia in 461 (88.0%) of the analyzed medical charts. The weightings corresponding to each chart, by hospital and outcome, were maintained for the analysis.

Table 1 shows frequencies, mortality, relative and population attributable risks, according to

Table 1 – Frequency of complications and their associations with mortality

Complication	Frequency		Mortality (%)			Relative risk		PAR
	%	95%CI	With complications	Without complications	p value	RR	95%CI	%
Low output	19.1	15.8-22.5	43.5	2.6	<0.00005	18.5	11.6-29.4	77.0
Renal failure	11.3	7.9-14.7	36.5	2.2	<0.00005	16.9	9.5-30.3	64.3
Cardiorespiratory arrest	8.1	6.7-9.6	80.1	4.1	<0.00005	19.8	15.1-25.9	60.4
Arrhythmia	17.0	13.0-20.9	26.3	6.9	<0.00005	3.8	2.6-5.6	32.2
Intraaortic balloon	12.4	9.4-15.5	33.0	7.0	<0.00005	4.7	3.2-6.8	31.6
Other CA device	1.2	0.4-1.9	29.8	10.0	<0.00005	6.1	4.3-8.7	38.9
Hyperglycemia	74.6	69.2-80.0	6.8	5.0	0.2876	1.4	0.8-2.5	21.8
Acute myocardial infarction	8.6	6.2-11.0	32.0	8.2	<0.00005	3.9	2.6-5.8	19.9
Hyperkalemia	8.1	5.3-11.0	22.6	6.4	<0.00005	3.5	2.0-6.1	17.2
Bleeding	9.4	6.3-12.4	25.9	8.6	<0.00005	3.0	1.9-4.7	15.9
Blood transfusion	31.0	25.2-40.0	14.0	8.7	0.0229	1.6	1.1-2.3	14.9
Septic shock	2.1	1.3-3.0	74.6	8.8	<0.00005	8.5	6.3-11.3	13.8
Heart failure	7.4	4.8-10.1	27.1	8.9	<0.00005	3.1	1.9-4.9	13.3
MODS	1.4	0.8-2.1	91.2	9.0	<0.00005	10.1	8.2-12.5	11.6
Coma	1.3	0.7-1.8	100.0	9.1	<0.00005	11.0	10.1-12.1	11.3
Pneumonia	6.9	4.1-9.7	25.4	9.1	0.0004	2.8	1.6-4.8	11.0
Stroke	2.3	1.3-3.4	54.0	9.2	<0.00005	5.9	3.7-9.5	10.7
ARDS	1.6	0.7-2.5	57.2	9.5	<0.00005	6.0	3.5-10.4	7.3
Other sites' infection	4.8	2.7-6.8	20.4	9.7	0.0282	2.1	1.1-4.0	5.0
Unstable angina	4.2	2.0-6.5	19.5	9.8	0.0806	2.0	0.9-4.2	4.0
Seizure	0.8	0.1-1.5	62.0	9.8	0.0012	6.3	2.8-14.5	3.9
Mediastinitis	1.3	0.4-2.1	35.3	9.9	0.0041	3.6	1.6-7.8	3.2
Respiratory prosthesis >24 h	12.4	9.6-15.2	38.2	6.2	0.0184	3.0	1.3-7.0	2.3
Free wall rupture	0.2	0.0-0.5	100.0	10.0	<0.00005	10.0	9.3-10.7	2.1
Peripheral vascular insufficiency	2.2	0.4-4.1	19.3	10.0	0.2237	1.9	0.7-5.4	2.0
Psychiatric conditions	2.6	0.9-4.2	16.4	10.1	0.3462	1.6	0.6-4.5	1.6
Pulmonary thromboembolism	0.3	0-0.6	58.5	10.1	0.0065	5.8	2.2-15.5	1.5
Sepsis	1.9	1.1-2.7	77.6	8.9	<0.00005	8.7	6.5-11.7	1.2
Tamponade	0.5	0.02-0.9	36.9	10.1	0.0353	3.7	1.2-10.8	1.2
Acute mitral reflux	0.1	0-0.4	100.0	10.1	0.0001	9.9	9.3-10.6	1.2
Pericarditis	0.6	0.0-1.3	23.3	10.1	0.3382	2.3	0.5-11.6	0.8
Soft tissue infection	2.3	0.7-4.0	12.6	10.2	0.7223	1.2	0.4-3.9	0.5
Amputation	0.2	0.0-0.4	23.6	10.2	0.4631	2.3	0.3-19.5	0.2
Deep vein thrombosis	0.3	0.0-0.7	10.2	13.4	0.8033	1.3	0.2-10.6	0.1
Limb revascularization	0.8	0.0-2.1	9.5	10.2	0.9403	0.9	0.1-6.6	-0.1
Inter-ventricular defect	-	-	-	-	-	-	-	-

PAR – population attributable risk; CI – confidence interval; RR – relative risk; CA – circulatory assistance; ARDS – acute respiratory distress syndrome; MODS – multiple-organ dysfunction syndrome.

complications in decreasing order of PAR values, for the 36 analyzed complications. Inter-ventricular defects were not identified in this population. Seizures, limb revascularization, pericarditis, tamponades, deep vein thrombosis, pulmonary thromboembolism, free wall rupture, amputations and acute mitral regurgitation were estimated to have occurred in less than 1.0% in patients who died, with their relative risks ranging from 0.9 (limb revascularization) to 10.0% (free wall rupture). The most frequent complication had a relative risk of 1.4 and a PAR of 21.8%. Some complications with less than 1% frequency, such as pericarditis, soft tissue infection, amputation, deep vein thrombosis and limb revascularization, had near-zero attributable risks. Low cardiac output, renal failure and cardiorespiratory arrest had greater than 60% attributable risks.

Table 2 describes the estimated mean lengths of stay and standard deviations from surgery until discharge or death, with or without complications. For

Table 2 – Association between hospital length of stay and complications

Complication	Absent		Present		p value			
	[1] Discharge*	[2] Death*	[3] Discharge*	[4] Death*	[1x2]	[3x4]	[2x4]	[1x3]
Low heart output	9.8 ± 0.6	14.8±3.1	12.0± 1.0	8.5± 1.3	0.11	0.03	0.06	0.06
Bleeding	9.9±0.6	7.7±1.3	11.5±1.6	16.2±2.7	0.12	0.13	0.0046	0.36
Tamponade	10.0±0.6	9.5±1.2	22.1±2.4	22.6±16.8	0.70	0.98	0.44	0.22
Intraaortic balloon	9.9±0.6	10.2±1.5	11.4±1.0	8.9±1.9	0.81	0.25	0.59	0.22
Other CA device	10.0±0.6	9.6±1.2	14.2±1.6	12.3±8.8	0.80	0.83	0.77	0.02
Blood transfusion	10.0±0.7	5.4±1.0	10.1±0.9	16.0±2.3	0.0002	0.01	<0.00005	0.99
Myocardial infarction	9.9±0.6	11.2±1.5	12.5±1.7	5.7±1.5	0.41	0.0022	0.01	0.14
Unstable angina	10.0±0.6	10.3±1.3	12.0±2.3	3.0±1.6	0.80	0.0013	0.0003	0.34
Cardiorespiratory arrest	10.0±0.6	12.4±2.3	12.8±1.1	8.2±1.3	0.30	0.01	0.10	0.03
Acute mitral reflux	10.0±0.6	9.8±1.2	-	1.6±0.6	0.88	-	-	<0.00005
IVD	10.0±0.6	9.7±1.2	-	-	0.81	-	-	-
Free wall rupture	10.0±0.6	9.7±1.2	-	8.8±3.8	0.80	-	-	0.70
Ventilation prosthesis >24 h	9.5±0.6	5.7±1.2	15.7±1.7	14.4±1.9	0.01	0.61	0.0002	0.001
Pneumonia	9.4±0.6	6.9±1.1	19.7±3.1	23.2±2.9	0.05	0.41	<0.00005	0.001
ARDS	9.9±0.6	9.4±1.3	23.1±8.5	13.2±3.9	0.68	0.29	0.44	0.12
Renal failure	10.2±0.9	9.1±2.4	12.2±1.5	18.7±3.0	0.66	0.05	0.01	0.26
Hyperglycemia	9.4±0.9	5.4±1.4	10.4±0.8	16.6±2.0	0.01	0.0049	<0.00005	0.42
Hyperkalemia	9.9±0.6	11.3±1.8	14.8±2.8	13.3±2.7	0.48	0.69	0.55	0.09
Stroke	9.9±0.6	7.0±0.9	18.4±2.5	29.0±5.2	0.01	0.07	<0.00005	0.0009
Coma	10.0±0.6	8.4±1.1	-	19.2±5.2	0.17	-	-	0.08
Seizures	10.0±0.6	8.7±1.0	25.0	30.6±10.9	0.27	0.61	0.05	<0.00005
Psychiatric conditions	10.1±0.6	9.5±1.2	8.5±1.2	15.6±2.9	0.65	0.02	0.05	0.20
Heart failure	9.7±0.6	9.7±1.4	14.5±1.7	9.7±2.0	0.99	0.07	0.98	0.0103
Pericarditis	10.0±0.6	9.7±1.2	12.3±3.9	11.0±4.0	0.80	0.89	0.76	0.57
PTE	10.0±0.6	9.7±1.2	47.0	8.4±3.2	0.85	<0.00005	0.71	<0.00005
Arrhythmia	9.7±0.7	9.7±1.7	12.1±1.0	9.7±1.6	0.10	0.21	0.10	0.05
Superficial infection	9.6±0.6	9.4±1.2	15.7±3.1	14.8±3.4	0.87	0.84	0.13	0.06
Soft tissue infection	10.0±0.6	9.6±1.2	14.0±4.4	11.9±5.4	0.81	0.77	0.68	0.37
Mediastinitis	9.8±0.6	8.5±1.1	36.3±4.4	35.1±6.4	0.31	0.88	0.0001	<0.00005
Sepsis	10.0±0.6	7.4±1.0	23.9±4.5	23.5±5.1	0.02	0.96	0.0019	0.001
Septic shock	10.0±0.6	7.5±1.2	22.4±3.5	21.3±3.7	0.06	0.84	0.0004	0.001
Other sites	9.7±0.6	9.0±1.3	18.4±2.1	16.6±3.5	0.63	0.67	0.04	0.0001
DVT	10.0±0.6	9.8±1.2	37.0±7.1	-	0.88	<0.00005	<0.00005	0.0002
Amputation	10.0±0.6	9.8±1.2	27.0	-	0.80	<0.00005	<0.00005	-
Peripheral arterial insufficiency	10.0±0.6	9.5±1.2	13.8±2.6	14.3±5.0	0.72	0.93	0.35	0.16
Limb revascularization	10.0±0.6	9.7±1.2	27.0	8.0±5.8	0.83	0.001	0.7688	<0.00005
MODS	10.0±0.6	7.7±1.1	26.0	23.1±4.8	0.06	0.5416	0.002	<0.00005

CA – circulatory assistance; IVD – inter-ventricular defect; ARDS – acute respiratory distress syndrome; PTE – pulmonary thromboembolism; DVT – deep vein thrombosis; MODS – multiple-organ dysfunction syndrome. Values of $p < 0.05$ considered statistically significant. * Values expressed as mean ± standard deviation.

each complication, four pairs of differences in mean postoperative stay had their statistical significance assessed.

Among the survivors, acute mitral regurgitation, free wall rupture and coma were not found. Deep vein thrombosis and amputation were not seen among the patients who died. From these cases, only coma had a frequency of greater than 1% (Table 1), and the lack of surviving patients with comas only allowed comparison of the mean lengths of stay of patients with or without this complication who died (non-significant difference).

The remaining complications showed different behaviors in the comparisons of the mean lengths of stay after surgery for the patients who died or were discharged. The use of intraaortic balloon pumps, the diagnosis of acute respiratory distress syndrome, hyperkalemia, pericarditis, pulmonary thromboembolisms, superficial infections, soft tissue infections, mediastinitis, peripheral arterial insufficiency and limb revascularization failed to show significant differences, both in patients who died and in those who were discharged, either having or not having complications.

DISCUSSION

This research allowed for a broad assessment of postoperative scenarios and identified several complications and their respective influences on mortality and length of hospital stay. The PAR calculation enabled understanding of the relevance of this influence and may allow for the design of strategies to control these complications and to help reduce CABG lethality, as assessed in these public hospitals in the city of Rio de Janeiro.

The most frequent complication, hyperglycemia, had a PAR of 21.8%, although its relative risk was low, at 1.4%. In 1997,[10] a study conducted in the United States included 432 hospitals and assessed 146,786 CABG patients, identifying diabetes in 28% of patients, with a 3.74% mortality, compared to 2.7% mortality in non-diabetic patients. Similar to our findings, although the mortality difference was not significant in this study (6.8% versus 5.0%; p = 0.29), due to its frequency, the absolute figures were remarkable.[10] Of the patients preoperatively considered non-diabetic, two-thirds had postoperative hyperglycemia. In the study by Carson et al.[10], despite either previous diagnoses of diabetes or the absence of diabetes, hyperglycemia had a negative effect, increasing mortality and other complications, such as infections, hemodynamic failures and acute myocardial infarctions.[10]

Hemodynamic failure-related complications, such as low output, requirement of intra-aortic balloon pumps or other circulatory assistance devices and heart failure, impacted lethality. Low cardiac output definitions in the literature involve situations in which mechanical support, such as intra-aortic contrapulsation balloon pumps or other circulatory assistance devices, are required.[11,12] Analyzed as a group, we found an estimated frequency of 25.6% and a PAR of 80.5%. Therefore, one-fourth of the patients are estimated to have developed at least one of the four conditions, with 34.2% mortality. Low output, in addition to a 77% PAR, was related to a significantly shorter length of stay in cases of death. Due to this high PAR, this complication was responsible for an estimated 12.2% of the mortality in this population.[1]

An intra-aortic contrapulsation balloon in CABG is used in approximately 1.5% to 17% of cases.[13] Its postoperative insertion is related to serious complications, and it is difficult to handle and has a poor prognosis, especially without evidence of ischemia. The preoperative use of this device is more common in U.S. hospitals and is reported to be more beneficial compared to postoperative use, when low output is already established.[13] The use of circulatory support is associated with a prolonged length of hospital stay.[14] In our analysis, no significant associations were found between these complications and the length of stay, although length of stay was shorter in patients who died than in those who survived, indicating that low cardiac output patients progress earlier to death.

Anthi et al.[15] considered cardiorespiratory arrest the terminal event of postoperative clinical deterioration, due to several causes.[15] These authors reported a 0.7% incidence of cardiorespiratory arrest in 3,982 cardiac surgery patients. In the present study, this complication occurred in 8.1% of the cases, with only one-eighth estimated to have survived. Patients who died had significantly shorter lengths of stay than survivors.

In this study, acute myocardial infarction was found twice as frequently as unstable angina (8.6% versus 4.2%). In the medical literature, postoperative infarction diagnoses range from 3% to 30%, due to different diagnostic criteria.[16] Our understanding is that postoperative infarction represents a progression from unstable angina, and it is frequently associated with death, with higher relative risk and, consequently, with PAR. Postoperative angina should be systematically

investigated, with the goal of early detection of acute myocardial infarction to minimize mortality. The length of hospital stay analysis showed similar significance, with the mean length of stay differing according to the outcome. Mean postoperative lengths of stay were shorter for patients who died, suggesting that myocardial ischemia-related conditions implied early death.

Renal failure was seen in this study in 11.3% of CABG patients, and it is described in the literature with a frequency between 1% and 30%. This wide range is due to the different definitions. Landoni et al.[17] found 35.3% mortality among 3,103 CABG patients who progressed to renal failure, a frequency that was similar to our finding of 36.5%. Renal failure frequency and relative risk (Table 1) resulted in a higher PAR of 64.3%. In our study, this value indicates that renal failure and low cardiac output are the most influential complications in terms of risk of death. It should be remembered that much renal failure information was lost, and this loss may have distorted our estimates.

In this study, 9.4% of hemostasis reviews were recorded. Karthik et al.,[18] studying 2,898 CABG patients from April 1999 to March 2002, identified a 3.1% reoperation rate for bleeding. This complication is associated with increased mortality. Roughly one-third of the studied population received a blood transfusion, and of these patients, one-third underwent reoperations for bleeding. The mortality among patients who were only transfused was 14%, increasing to 25.9% for reoperation patients.

CABG was established as an effective therapeutic option for patients with left ventricular dysfunction due to ischemic disease;[19] these patients' mortality was low, although their length of hospital stay was long. In this sample, we found 27.1% mortality in patients with postoperative cardiac failure. In a previous report, the authors found no association between preoperative left ventricular dysfunction and death.[1] Arrhythmia, which includes several rhythm disorders, had a frequency of 17.0% and a PAR of 32.2%. The most frequent postoperative arrhythmia, atrial fibrillation, was identified by other authors as having a frequency between 10% and 40%, influencing the length of hospital stay.[20]

The high mortality identified in this population, especially early death, was associated with complications, such as low cardiac output and cardiorespiratory arrest, with attributable risks greater than 60%, apparently limiting the benefits of CABG in preoperative conditions such as ischemic heart failure. The data indicate that the surgical procedure or postoperative issues had more influence on myocardial loss than preoperative heart failure.[1] Therefore, postoperative mortality was 8.0% in patients without preoperative and postoperative heart failure. In patients who developed postoperative heart failure, mortality increased to 31.7%. When heart failure was diagnosed preoperatively, but not postoperatively, mortality was 10.5%, and when it was maintained during the postoperative period, mortality was 22.4%. Apparently, patients without heart failure who developed this condition after surgery had poorer prognoses, even compared to patients who maintained this diagnosis.

Among infectious complications, the most frequent was "other infections." This variable represents a set of infections with different clinical impacts and a PAR of 5%. The frequency of mediastinitis was 1.3%, close to the findings of Borger et al.,[21] who found this complication in 0.75% of their sample of 12,267 CABG patients. Although responsible for a longer mean length of stay, both for patients who died and for survivors, a comparison of the mean stay time according to the outcome showed no significant differences. Sepsis and septic shock, although clinically related, had different risks: the septic shock PAR was ten times the sepsis PAR. A possible explanation is that approximately 60% of the sepsis cases were reported as venous catheter-related, which could explain their lowest influence on the mortality of this series and others.[22]

More than 10 hours of mechanical ventilation has been reported to be predictive of postoperative pneumonia, with an incidence of 3% to 34% and mortality between 20% and 50%.[23] In our study, one half of the patients under prolonged mechanical ventilation progressed to pneumonia, and of these patients, 70% died. This finding explains why the pneumonia PAR was about five times greater than the PAR for prolonged mechanical ventilation. In both, the influence on the length of hospital stay was similar. Strategies to shorten postoperative ventilation time[24] are apparently useful in minimizing ventilation's negative influence on mortality and length of stay.

Neurological conditions constitute two subgroups: type I, encompassing stroke and coma, and type II, represented by seizures and psychiatric conditions.[25] Initially, this distinction was observed with regard to death. Roughly one half of patients with diagnoses of stroke progressed to coma; this finding is important

because all patients with coma eventually died. Both complications had similar attributable risks, approximately 11%, and their mean lengths of stay times were longer in patients who died. Type II complications were less influential on mortality, likely due to their low impact on ventilation disorders and infections. Psychiatric conditions can have a meaningful impact on quality of life that can be found even in prolonged follow-up of up to five years.[26]

In a review of seven series that included 2,229 patients, pulmonary thromboembolisms were reported in 3.4% of postoperative CABG patients. In these patients, this complication was fatal in 0.5% of the cases.[27] In this study, the mean time to thromboembolism was twelve days. During the CABG postoperative period, the immobilized patient is apparently more subject to hypercoagulability and endothelial trauma.[28] Therefore, conditions prolonging the hospital stay favor this complication, making it responsible for the longer hospital lengths of stay of surviving patients.

Considering the mean length of stay of 9.5 days in non-complicated patients, the different mean times, according to the complications and outcomes, show the importance of controlling these events to prevent their influence on mortality, as well as their influence on the length of stay, with the consequent financial implications.[29] Renal failure was previously identified to impact negatively the length of hospital stay and mortality, as seen in this study; this finding underscores the need to invest in strategies that are able to prevent and treat this condition.[30]

This study design did not include collecting information on postoperative event chronology; only information on outcome, either discharge or death, was collected. Consequently, and because of the sample design, the interrelationships among the different complications could not be assessed. This type of evaluation would require multivariate hierarchical models, which would require a larger number of observations. Therefore, we were limited to individually analyzing each complication, and in this discussion, we recognize their clinical and etiological connections.

A limitation of this study is that the identification of death required rigorous criteria, rendering the detection of death less sensitive and possibly rendering the detection of this event below the actual total. Expansion of the collected results may incur errors we intended to minimize using sample randomization. Regarding the association of conditions, the information sources — the medical chart — limitations should be considered, as reported by Oliveira et al.[31]

CONCLUSION

Several complications were identified in the postoperative period of CABG, with different frequencies and impacts on mortality. Retrospective attributable risk values highlight the importance of low cardiac output and renal failure on fatal outcomes. We conclude that effective postoperative measures are necessary, such as the protection of the myocardium at the risk of ischemia, volume replacement and hemodynamic stabilization, which can effectively help control CABG patients' mortality.

RESUMO

Objetivo: Avaliar associações das complicações pós-operatórias, em pacientes que sobreviveram à sala de operações, com óbito intra-hospitalar e tempo de internação de pacientes submetidos à cirurgia de revascularização miocárdica.

Métodos: Foram selecionados aleatoriamente pacientes submetidos à cirurgia de revascularização miocárdica e sobreviventes a sala de operações. Informações sobre complicações e tempo de hospitalização até alta ou óbito foram coletadas retrospectivamente dos prontuários e declarações de óbitos. Estimaram-se segundo presença de complicações, freqüências, letalidade, risco relativo e risco atribuível populacional. As médias de tempo de internação foram comparadas com a estatística de Wald.

Resultados: Excluídos prontuários correspondentes aos óbitos da sala de operações e em 86,9% foram identificadas informações sobre complicações, na insuficiência renal houve maior perda de informações (43,9%). Hiperglicemia foi estimada mais freqüente (74,6%), porém com risco atribuível populacional de 31,6%. O risco atribuível populacional foi maior que 60% no baixo débito (77,0%), insuficiência renal (64,3%) e parada cardiorrespiratória (60,4%). Identificamos 12 situações de combinações das significâncias dos pares das diferenças entre médias de tempo de internação pós-operatória de acordo com presença de complicações e evolução para alta ou óbito.

Conclusão: São várias complicações identificadas no período pós-operatório da revascularização miocárdica, com freqüências e repercussões diversas sobre letalidade. Controle do miocárdio sob risco de isquemia, estratégias de reposição volêmica, estabilização hemodinâmica, podem ser eficazes no controle da letalidade e tempo de internação.

Descritores: Revascularização do miocárdio; Procedimentos cirúrgicos cardíacos; Tempo de internação; Letalidade; Complicações pós-operatórias

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