

Evolution of elderly patients who underwent cardiac surgery with cardiopulmonary bypass

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CPB: cardiopulmonary bypass

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ABSTRACT

Introduction: There is a steady increase in the number of elderly patients with severe cardiovascular diseases who require a surgical procedure to recover some quality of life that allows them a socially meaningful existence, despite the risks.

Objectives: To analyze the behavior of elderly patients who underwent cardiac surgery with cardiopulmonary bypass.

Method: A descriptive, retrospective, cross-sectional study was conducted with patients over 65 years of age who underwent surgery at the Cardiocentro Ernesto Che Guevara, in Santa Clara, from January 2013 to March 2014.

Results: In the study, 73.1% of patients were men; and there was a predominance of subjects between 65 and 70 years of age, accounting for 67.3%. Coronary artery bypass graft was the most prevalent type of surgery and had the longest cardiopulmonary bypass times. Hypertension was present in 98.1% of patients. The most frequent postoperative complications were renal dysfunction and severe low cardiac output, with 44.2% and 34.6% respectively.

Conclusions: There was a predominance of men, the age group of 65 to 70 years, hypertension, and patients who underwent coronary artery bypass graft with prolonged cardiopulmonary bypass. Renal dysfunction was the most frequent complication.

Key words: Elderly, Cardiac surgery, Cardiopulmonary bypass

Comportamiento de los pacientes ancianos operados de cirugía cardíaca con circulación extracorpórea

RESUMEN

Introducción: Cada día se incrementa el número de pacientes añosos con enfermedades cardiovasculares graves, que requieren de un acto quirúrgico para devolverle cierta calidad de vida que los haga socialmente útiles, a pesar de los riesgos.

Objetivos: Analizar el comportamiento de los pacientes añosos sometidos a cirugía

cardíaca con circulación extracorpórea.

Método: Se realizó un estudio descriptivo, retrospectivo, transversal, con los pacientes de más de 65 años de edad intervenidos quirúrgicamente en el Cardiocentro Ernesto Che Guevara, de Santa Clara, desde enero del 2013 a marzo del 2014.

Resultados: El 73,1 % fueron hombres y predominaron los pacientes comprendidos entre los 65 y 70 años con un 67,3 %. La revascularización miocárdica fue la cirugía de más incidencia y tiempos prolongados de circulación extracorpórea. El 98,1 % padecían de hipertensión arterial. Las complicaciones posoperatorias más frecuentes fueron la disfunción renal y el bajo gasto grave con 44,2 y 34,6 % respectivamente.

Conclusiones: Predominaron los hombres, de 65 a 70 años, hipertensos, sometidos a revascularización miocárdica con circulación extracorpórea prolongada, siendo la disfunción renal la complicación más frecuente.

Palabras clave: Anciano, Cirugía cardíaca, Circulación extracorpórea

INTRODUCTION

Improving living conditions has contributed to an increase in the average life expectancy of individuals in the world¹. In Cuba, the population has been undergoing a gradual aging process for several years. It implies a readjustment of the national infrastructure and the design of new policies especially in the areas of social security and health care².

The World Health Organization (WHO) regards all those individual aged 65 or older as elderly¹, mainly with respect to social benefits.

There is a steady increase in the number of elderly patients with severe cardiovascular diseases who require a surgical procedure to recover some quality of life that allows them a socially meaningful existence, despite the risks.

These patients are characterized by a reduced functional capacity in most organs, which hardly tolerate situations that are compensated in young adults by the existing functional reserves. Thus, the incidence of neurological and psychiatric complications—especially cerebrovascular accidents—respiratory failure, renal failure, sepsis, among others, increases proportionally with age. They also suffer from intrinsic heart aging, which includes the slowly progressive structural and anatomical changes faced by the heart in the absence of major cardiovascular risk factors³.

For several years the studies on cardiac surgery in the elderly patients show that with the improvement of surgical techniques and technologies the results are satisfactory, although there are more complications, and higher postoperative mortality and morbidity. In

some studies, it is considered that old age is just a minor risk factor for postoperative morbidity and mortality in patients with heart surgery, despite having a higher number of comorbidities and less physiologic reserve of the different organ systems⁴.

It is imperative that the surgical team is prepared to face this challenge. Among them, the perfusionists have great importance, because all the harmful effects of cardiopulmonary bypass (CPB) in the body must be taken into account, so the decision made by the specialist can make a difference.

The objective of this research was to analyze the behavior of elderly patients after cardiac surgery with CPB.

METHOD

Population and type of study

A descriptive, retrospective, cross-sectional study was conducted in patients over 65 years of age who had undergone surgery at the Cardiocentro Ernesto Che Guevara, in Santa Clara, from January 2013 to March 2014. No patient was excluded; the sample was intentional and coincides with the study population. The variables and data were obtained from medical records, perfusion forms and the intensive care registry. Descriptive statistics was used for the representation of data in tables.

The study met the standards set by international codes of medical ethics.

Processing techniques, analysis and presentation of results

A database was created in Microsoft Excel 2010 and SPSS 15 with the primary data. Frequency measurements were used for statistical analysis, and percentage for its distribution. Chi square test of independence was used to determine the relationship between variables.

Different levels of significance of the variables were established: $p > 0.05$, not significant; $p < 0.05$, significant; $p < 0.01$, very significant and $p < 0.001$, highly significant.

The information obtained was shown in tables for better interpretation.

RESULTS

Table 1 shows the frequency distribution of the age groups with a predominance of patients between 65 and 70 years of age, accounting for 67.3%, and sudden decline in the number of patients as the age increases.

The distribution of patients by sex is shown in **Table 2**, where the predominance of male patients can be seen (73.1% males vs. 26.9% females).

The distribution of patients according to the type of surgery by sex is shown in **Table 3**, where coronary artery bypass graft was more frequent in males, with 21 patients (55.3%), and in general, as a higher incidence of this disease was also found with 24 patients (46.1%), hence highly significant differences ($\chi^2=21.5$; $p=0.006$) were found. Following these results appears aortic valve replacement with 21.1% of cases.

Table 4 shows the distribution of patients by past medical history, where there was a predominance of hypertensive patients (51 patients, 98.1%), followed by coronary artery disease and diabetes mellitus, thus highly significant differences were found ($p=0.001$) in regard of hypertension.

More than half of

Table 1. Distribution of patients operated on according to age groups. Cardiocentro Ernesto Che Guevara of Santa Clara, Villa Clara, Cuba. January 2013- March 2014.

Age group (years)	Nº	%
65 - 70	35	67,3
71 - 75	11	21,2
76 - 80	5	9,6
Over 80	1	1,9
Total	52	100

Source: Perfusion forms and medical records.

Table 2. Distribution of patients operated on by sex.

Sexo	Nº	%
Male	38	73,1
Female	14	26,9
Total	52	100

the interventions (59.6%) were prolonged considering the CPB time (**Table 5**), which was related to the complexity of the surgical procedure. Perfusion, in all cases, was governed by the protocol of our service for elderly patients, which includes important measures such as the maintenance of mean arterial pressure above 60 mmHg, hematocrit above 25%, the use of ultrafiltration, controlled hemodilution, among the most

Table 3. Distribution of patients according to the type of surgery by sex.

Type of surgery	Male		Female		Total	
	Nº	%	Nº	%	Nº	%
Coronary artery bypass graft (CABG)	21	55,3	3	21,4	24	46,1
Aortic valve replacement (AVR)	8	21,1	3	21,4	11	21,1
Mitral valve replacement (MVR)	3	7,9	6	42,9	9	17,3
MVR and AVR	4	10,5	2	14,3	6	11,6
CABG and AVR	2	5,2	0	0	2	3,9
Total	38	100	14	100	52	100

$\chi^2=21.5$ $p=0.006$

Table 4. Distribution of patients by past medical history.

Past medical history	Nº	%
Hypertension	51	98,1
Coronary artery disease	33	63,4
Diabetes mellitus	18	34,6
COPD	14	26,9
Smoker	11	21,1
Others	6	11,5

$\chi^2=13.2$ $p=0.001$

Table 5. Distribution of patients undergoing surgery, according to the duration of the CPB.

Duration (minutes)	Nº	%
Less than 120	21	40,4
More than 120	31	59,6
Total	52	100

Table 6. Incidence of major complications in patients aged 65 years or older who underwent cardiac surgery.

Postoperative complications	Nº	%
Renal dysfunction	23	44,2
Postoperative low cardiac output	18	34,6
Prolonged ventilation	14	26,9
Neurological dysfunction	4	7,6
Severe respiratory sepsis	3	5,7
Metabolic disorders	3	5,7
Anemia	2	3,8
Sternal dehiscence	1	1,9
Death	2	3,8

Source: Statistical records, patient database, individual medical records and registration of patients discharged from the Intensive Care Unit of the Cardiocentro Ernesto Che Guevara.

important ones.

Table 6 shows the incidence of postoperative com-

plications. Renal dysfunction was the most frequent complication with an incidence of 44.2%, which is higher than that reported by other authors, as Parolari *et al*⁶ (8.9%), Swaminathan *et al*⁷ (10.8%), D'Onofrio *et al*⁸ (23.5%) and Brown *et al*⁹ (39%). Postoperative low cardiac output was the second most common complication, being present in 34.6%. This figure is within the range of recorded values, which according to Álvarez *et al*¹⁰, Rudiger *et al*¹¹ and Mebazaa *et al*¹², is from 3 to 45%.

DISCUSSION

The general deterioration of the body with the passing of time is the pathological substrate that makes old age to be considered a major risk factor in countless health disorders, increasing surgical risk to unacceptably high levels. However, with the aging of global population and the associated morbidity, there is an increase in the number of patients who need cardiovascular surgery, trying to improve their quality of life^{13,14}. Our results contrast with other studies, where the number of octogenarian patients with heart surgery is greater. Craver *et al*¹⁵ published the results of a consecutive series of 601 octogenarians who underwent a variety of surgical procedures, including coronary artery bypass grafting, aortic and mitral valve replacement, alone and in various combinations. The overall mortality was 9.1%, with a survival rate at 5 years of 55% for octogenarians, 69% for those aged 70 to 79 years and 81% for patients aged 60 to 69 years. In another study, Blanche *et al*¹⁶ analyzed the results of cardiac surgery in 30 patients aged 90 years or older, with a hospital mortality of 10%.

The sex distribution in the study is similar to that of large studies such as William *et al*⁵, where in a group of 300 octogenarian patients with coronary artery bypass surgery, 31.3% were women. Female sex is considered a risk factor for heart surgery. Some studies suggest that female sex is an independent risk factor for postoperative morbidity and mortality. Possible explanations for this phenomenon could be that women are intervened at older ages and more urgently than men, they also receive fewer arterial grafts. They also have finer coronary arteries, which represents a greater difficulty for performing the anastomosis¹³.

The most frequent heart surgeries performed on

elderly patients are: coronary artery bypass graft; ventricular aneurysm surgery, as complications of myocardial infarction; valve surgery, especially aortic valve surgery due to degenerative changes, and the surgery of aortic aneurysms and dissections. The optimized performance of surgery, myocardial protection and a perfusion focused on the specific needs of the age group provide results that are similar to those in younger patients¹⁷. Baguneid *et al*¹⁸ state that in the last 10 years the number of elderly patients undergoing coronary artery bypass surgery increased 5 times, with a mortality rate 3.5 times higher compared to 1.8 in young patients.

An increase in blood pressure may compromise cardiac, cerebral and renal function. More than 50% of people over 65 years of age suffer from hypertension, due to the rigidity of arterial walls. This is a fact of great value for the perfusionist, who needs to keep higher mean arterial pressures throughout the CPB (60-85 mmHg). Isolated systolic hypertension increases the risk of cardiovascular disease about 2-5 times, and the risk of stroke by 2.5 times. Overall mortality rates are higher than in the normotensive population¹⁹.

Diabetes mellitus is an important independent risk factor for coronary atherosclerotic vascular disease, and a significant predictor of in-hospital mortality after coronary artery bypass surgery. It is associated with renal and neurological complications, prolonged stay in the intensive care unit, increased number of blood transfusions, respiratory complications, and reinterventions^{20,21}.

Patients with chronic obstructive pulmonary disease (COPD) present more difficulties for removing the ventilation. There is a 19% mortality associated with severe COPD, 4% for moderate to mild COPD and 2% for patients without it²².

The aging process is accompanied by a substantial reduction of renal function; and CPB may affect even more the renal system in these patients, compared to young patients. During surgery, the CPB affect the formed elements of the blood so that free hemoglobin and microparticles are produced, which negatively affects kidney function, together with other factors such as: hypothermia, overheating, vasodilation and hyperemia, with accumulation in the third space; hemodilution, ischemic/reperfusion damages, the release of catecholamines, hormones —such as renin, angiotensin, aldosterone, vasopressin, atrial natriure-

tic peptide— and inflammatory cytokines. Therefore, there is an increase in renal vascular resistance, a reduction of its perfusion and a drop in glomerular filtration. Hypotension and the use of vasopressors in the postoperative accentuate renal involvement, coupled with the lack of centrifugal pumps. Elderly patients are quite sensitive to develop acute renal failure during episodes of hypotension, heart failure, hypovolemia, dehydration, sepsis and neurotoxic agents^{23,24,25}.

The prevalence of cardiac surgery in elderly patients is continuously increasing together with their life expectancy. Surgical results have improved steadily despite the increasing age of the patients treated worldwide. However, perioperative morbidity and mortality, as well as neurological and renal complications, are higher in these patients than in younger age groups. Similarly, they are more likely to need prolonged ventilation and require reoperation due to postoperative bleeding, especially after CPB⁴⁻¹⁵.

CONCLUSIONS

Among the elderly patients who underwent cardiac surgery, there was predominance of men aged 65 to 70 years, and a past medical history of hypertension and coronary artery disease. The predominant type of surgery was coronary artery bypass graft, followed by aortic valve replacement, with prolonged CPB time most of the time. The most common postoperative complication in these patients was renal dysfunction, followed by postoperative low cardiac output.

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