Real Facts in Cardiovascular Surgery in Argentina. The XVI CONAREC Registry

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SUMMARY

Background
The CONAREC and the ESMUCICA studies are the largest multicenter registries performed in Argentina more than 10 years ago. The clinical and surgical advances achieved during the last decade have obliged us to carry out a new national, prospective and multicenter registry to become aware of the characteristics, outcomes, complications and predictors of mortality of patients undergoing cardiac surgery.

Objectives
To recognize the epidemiologic profile, surgical approach and postoperative outcomes of patients undergoing cardiac surgery in Argentina.

Material and Methods
This is a prospective, consecutive and multicenter registry performed by residents in Cardiology in 49 centers with cardiovascular surgery facilities. A total of 2553 patients undergoing cardiac surgery were included between September 2007 and October 2008, distributed as follows: coronary artery bypass graft surgery, 1465 patients (57.4%); aortic valve replacement, 359 (14.1%); mitral valve surgery, 169 (6.6%); combined procedure (revascularization-valve surgery), 312 (12.2%); other procedures, 248 (9.7%).

Results
There were more men (74.9%) than women; mean age was 63±11 years. The prevalence of diabetes was 24.9%, of hypertension 76.3% and of heart failure 17%. Preoperative moderate to severe left ventricular dysfunction was 23.8%, and 19.8% of surgeries were done on an urgent or emergency basis.
A 41.9% of coronary artery bypass graft surgeries were done without cardiopulmonary bypass and a mammary artery bypass graft was used in 89%.
Mitral valve surgery was indicated due to mitral regurgitation in 81.7% of cases and 63.6% of aortic valve surgeries were due to aortic valve stenosis. Mechanical heart valve prostheses were used in 58% of cases.
Patients were hospitalized for a median of 6 days. Major complications occurred in 31.7% of cases (25% in revascularization surgeries and 49.36% in combined procedures) and global mortality was 7.7% (4.3% and 49.36%, respectively).

Conclusions
This registry demonstrates the real facts in cardiovascular surgery in centers with cardiovascular residents in Cardiology. Mortality and major complications are lower than those reported by previous registers, yet they are still high.

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Key words > Cardiovascular Surgery - Mortality - Major Complications - Predictors of Mortality

Abbreviations >

IABP	Intraaortic balloon pump	CABGS	Coronary artery bypass graft surgery
CS	Cardiovascular Surgery	MVS	Mitral valve surgery
CP	Combined procedure	LVD	Left ventricular dysfunction
CPB<	Cardiopulmonary bypass	AVR	Aortic valve replacement
CK-MB	Creatine kinase MB fraction		

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BACKGROUND

Two large multicenter registries in cardiovascular surgery (CS) have been developed in Argentina: the CONAREC III registry (1) and the ESMUCICA study (Estudio Multicéntrico de Cirugía Cardíaca, Multicenter study in Cardiovascular Surgery). (2, 3) The CONAREC III registry included 1293 patients undergoing coronary artery bypass graft surgery (CABGS) in 41 centers nationwide between October 1992 and September 1993, and the ESMUCICA study included 2125 patients (70% undergoing CABGS and 30% valvular surgery) in 4 high-volume centers in Buenos Aires between August 1996 and July 1997.

Both studies were performed more than ten years ago and their results differed significantly.

The clinical and surgical advances achieved during the last decade have obliged us to carry out a new national, prospective and multicenter registry to become aware of the characteristics, outcomes, complications and predictors of mortality of patients undergoing cardiovascular surgery.

MATERIAL AND METHODS

The CONAREC XVI is multicenter and prospective registry of consecutive patients > 18 years undergoing cardiovascular surgery between September 2007 and October 2008 in 49 centers of 16 provinces in Argentina with cardiac surgery facilities and a cardiology residency program.

Patients were included after an electronic form available at the CONAREC web site was completed using a personal password.

Clinical history, surgical data and in-hospital outcomes were recorded.

Any of following were considered major complications:

1. Perioperative myocardial infarction: development of new and persistent Q-waves of at least 0.04 ms in two consecutive leads and/or 25% R wave reduction, CK-MB ≥ 80 UI/ml, and/or wall motion abnormalities in the echocardiogram.
2. Low cardiac output syndrome: systolic blood pressure < 90 mm Hg, pale and cold skin, increased capillary refill time, clouding of consciousness and oliguria, cardiac index < 2.2 L/min/m^2, pulmonary capillary wedge pressure > 18 mm Hg, requirement of more than one inotropic agent or intraaortic balloon pump (IABP).
3. Kidney failure: increase of > 50% in basal creatinine levels and/or hemodialysis requirement.
4. Stroke: focal or diffuse brain lesion confirmed by clinical findings and/or computed tomography scan with neurological deficits at discharge.
5. Mediastinitis: clinical signs and/or positive cultures.
6. Sepsis: positive blood culture and two of the following criteria: a) fever > 38.5 °C; b) white blood cell count > 15000/ml; c) positive culture of the primary source of infection; and, d) mean blood pressure < 60 mm Hg for at least two hours.
7. Respiratory distress syndrome: acute respiratory failure characterized by a PaO_2/FiO_2 ratio < 200 in the presence of bilateral alveolar infiltrates on the chest x-ray and pulmonary capillary wedge pressure < 18 mm Hg.
8. Reoperation: need to repeat sternotomy after leaving the operating room.

Random independent audits reviewed 30.86% of the registries in order to ensure that patients were consecutively included. For this purpose, the surgical lists of the centers assigned were compared with the database of the CONAREC. The auditing system also controlled the inclusion and exclusion criteria, and the veracity of 7.83% of the medical records.

Statistical Analysis

Quantitative variables with parametric and non parametric distribution were presented as mean and standard deviation, or median and interquartile range, respectively, and were analyzed using Student's t test and Wilcoxon test for comparisons between two groups, respectively. Qualitative variables were expressed as percentages, and statistical significance was determined using chi square test. We also calculated the odds ratio (OR) with its corresponding 95% confidence interval (CI). A two-tailed p value < 0.05 was considered statistically significant. All variables with p < 0.10 in univariate analysis underwent multivariate analysis to establish independent predictors. Statistical analysis was performed using Stata statistical package for Windows (Version 10.0, StataCorp, Texas, USA).

RESULTS

General population

A total of 2553 patients were included, distributed as follows: CABGS, 1465 patients (57.4%); aortic valve replacement (AVR), 359 (14.1%); mitral valve surgery (MVS), 169 (6.6%); combined procedure (revascularization-valve surgery) (CP), 312 (12.2%); other procedures, 248 (9.7%). The latter group was too heterogeneous to be analyzed, as included double valvular replacement, aortic valve replacement associated with replacement of the ascending aorta, tricuspid valve surgery and, finally, CABGS combined with any of these procedures.

Patients' basal characteristics are displayed in Table 1.

There were more men (74.9%) than women; mean age was 63 ± 11 years. The prevalence of diabetes was 24.9%; 76.3% of patients had hypertension and 17% had heart failure. The incidence of previous chronic obstructive pulmonary disease was 9.4%, kidney failure 7.8%, stroke 3.9%, peripheral vascular disease 7.7% and CS 3.9%. Preoperative moderate to severe left ventricular dysfunction (LVD) was 23.8%, and 19.8% of surgeries were non-elective.

Major complications occurred in 31.7% of cases and overall mortality was 7.7% (Table 2). Patients were hospitalized for a median of 6 days (6 for CABGS, 7 for VS and 8 for CP).

Coronary artery bypass graft surgery

A total of 1465 patients were included. Mean age was 63 ± 9.2 years and 82.9% were men. Basal characteristics are displayed in Table 1. Unstable angina was the most prevalent clinical presentation before surgery (52.7%) Left ventricular dysfunction was present in 25.7% of cases. In 28.4% of patients, there was evidence of severe lesions in the left main coronary artery (LMCA); 89.7% had lesions in the left anterior descending coronary

Table 1. Basal characteristics of the populat

Complication	All n = 2.553	CABGS n = 1.465	AVR n = 359	MVS n = 169	Combined procedures n = 312
Age	63 ± 11	63 ± 9.27	64.8 ± 12.4	59.2 ± 12	69.8 ± 9.4
Female gender	1.912 (74.9%)	1.214 (82.9%)	227 (63.2%)	76 (44.9%)	232 (74.4%)
History					
Smoking habits	987 (38.31%)	625 (42.66%)	108 (30.1%)	40 (23.6%)	118 (37.8%)
Diabetes	635 (24.87%)	446 (30.44%)	63 (17.55%)	14 (8.28%)	82 (26.3%)
Dyslipemia	1.443 (56.5%)	1.006 (68.7%)	132 (36.7%)	35 (20.7%)	188 (60.3%)
HT	1.948 (76.3%)	1.214 (82.8%)	232 (64.6%)	83 (49.1%)	255 (81.7%)
COPD	240 (9.4%)	121 (8.26%)	30 (8.36%)	20 (11.8%)	39 (12.5%)
Previous MI	615 (24.09%)	1.028 (36.1%)	8 (2.3%)	4 (2.37%)	55 (17.6%)
IAM < 30 días	129 (5.05%)	111 (7.57%)	2 (0.56%)	1 (0.59%)	13 (4.2%)
Previous CABGS	40 (1.51%)	15 (1.02%)	8 (2.23%)	2 (1.18%)	12 (3.85%)
Previous valve surgery	69 (2.7%)	3 (0.2%)	20 (5.57%)	16 (9.47%)	8 (2.56%)
Previous angioplasty	301 (11.79%)	243 (16.59%)	9 (2.51%)	5 (2.96%)	35 (11.22%)
Previous CKF	200 (7.83%)	100 (6.84%)	28 (7.8%)	12 (7.10%)	41 (13.14%)
Hemodialysis	14 (0.55%)	5 (0.34%)	3 (0.84%)	2 (1.18%)	2 (0.65%)
Previous stroke	101 (3.96%)	58 (3.96%)	17 (4.74%)	7 (4.14%)	10 (3.25%)
Peripheral vascular disease	196 (7.68%)	140 (9.56%)	9 (2.51%)	2 (1.18%)	35 (11.22%)
Moderate to severe LVD	607 (23.78%)	376 (25.67%)	68 (18.94%)	21 (12.4%)	88 (28.2%)
Clínical presentation					
Asymptomatics	288 (11.28%)	183 (12.49%)	24 (6.69%)	16 (9.47%)	22 (7.05%)
Unstable angina	895 (35.06%)	772 (52.7%)	30 (8.36%)	3 (1.78%)	66 (21.15%)
Stable chronic angina	597 (23.38%)	423 (28.87%)	58 (16.16%)	3 (1.78%)	85 (27.2%)
Syncope	140 (5.48%)	32 (2.18%)	54 (15.04%)	8 (4.73%)	30 (9.6%)
IChronic CHF	435 (17.04%)	111 (7.58%)	99 (27.58%)	68 (40.2%)	93 (29.8%)
Acute CHF	134 (5.25%)	46 (3.14%)	21 (5.85%)	15 (8.88%)	29 (9.3%)
Cardiogenic shock	26 (1.02%)	9 (0.61%)	0 (0%)	7 (4.14%)	3 (0.97%)
Inotropic agents	67 (2.62%)	25 (1.71%)	10 (2.79%)	7 (4.14%)	12 (3.85%)
IABP	39 (1.53%)	31 (2.12%)	0 (0%)	1 (0.59%)	4 (1.28%)
Non-elective surgery	505 (19.78%)	373 (25.46%)	37 (10.31%)	16 (9.47%)	45 (14.4%)
EuroSCORE mortality		2.62-3.51%	3.51%-6.51%	3.51%-6.51%	6.51%-8.37%

CABGS: Coronary artery bypass graft surgery. AVR: Aortic valve replacement MVS: Mitral valve surgery HT: Hypertension. COPD: Chronic obstructive pulmonary disease. MI: Myocardial infarction. CKF: Chronic kidney failure. LVD: Left ventricular dysfunction. CHF: Congestive heart failure IABP: Intraaortic balloon pump

artery (LAD), 74.4% in the circumflex coronary artery (LCX) and 74.5% in the right coronary artery (RCA). Three-vessel coronary artery disease was present in 56.2% of patients.

In 25.5% of cases the procedures were non-elective, and 2.4% were done on an emergency basis. Intraaortic balloon pump was required in 2.1%.

The percentage of grafts implanted was 2.8 ± 0.94. The left internal mammary artery (LIMA) graft to the LAD was used in 93.8% of cases and radial artery grafts in only 13.9%.

Overall mortality was 4.3% (predicted EuroSCORE: 2.62-3.51%) and the incidence of complications was 24.9% (Table 2).

Table 2. Major complications and mortality according to the procedure

Complication	All n = 2.553 n (%)	CABGS n = 1.465 n (%)	AVR n = 359 n (%)	MVS n = 169 n (%)	Combined procedures n = 312 n (%)
IAM posoperatorio	123 (4.82%)	87 (5.94%)	8 (2.23%)	4 (2.37%)	17 (5.45%)
SBVM	590 (23.1%)	241 (16.45%)	63 (17.55%)	58 (34.32%)	129 (41.3%)
Insuficiencia renal	339 (13.3%)	119 (8.81%)	43 (11.98%)	26 (15.38%)	73 (23.4%)
ACV	28 (1.1%)	9 (0.61%)	8 (2.23%)	5 (2.96%)	8 (2.56%)
Mediastinitis	48 (1.88%)	27 (1.84%)	11 (3.06%)	1 (0.59%)	5 (1.6%)
Sepsis	114 (4.5%)	44 (3%)	21 (5.85%)	6 (3.55%)	24 (7.7%)
Distrés respiratorio	93 (3.64%)	44 (3%)	16 (4.46%)	7 (4.14%)	14 (4.5%)
Reoperación	147 (5.76%)	62 (4.23%)	21 (5.85%)	12 (7.1%)	34 (9.77%)
Complicaciones mayores (global)	809 (31.7%)	366 (24.98%)	105 (29.2%)	67 (39.64%)	154 (49.36%)
Mortalidad	196 (7.68%)	63 (4.3%)	32 (8.91)	18 (10.65%)	42 (13.4%)

CABGS: Coronary artery bypass graft surgery. AVR: Aortic valve replacement MVS: Mitral valve surgery MI: myocardial infarction. LCOS: Low cardiac output syndrome

On-pump versus off-pump coronary artery bypass surgery

A total of 851/1465 patients (58.1%) and 614/1465 (41.9%) underwent on-pump and off-pump surgery, respectively. Both procedures were performed in 38 centers (76%) and off-pump surgery was carried out in 12 (24%) centers.

There were no differences in age, gender and ventricular function between both groups. Patients undergoing off-pump surgery had a greater prevalence of diabetes (33.5% vs. 28.2%; $p < 0.03$) and previous stroke (5.2% vs. 3.1%; $p < 0.04$). Cardiopulmonary bypass (CBP) was more frequently used in lesions of the LMCA (31.9% vs. 23.4; $p < 0.01$) and in non-elective surgeries (27.5% vs. 22.6%; $p < 0.004$); although the mean number of coronary grafts was greater in the latter (3.1 ± 0.8 vs. 2.5 ± 0.9; $p < 0.001$) there were no differences in the use of venous or radial grafts. On-pump surgeries had greater incidence of complications (28.2% vs. 20.5%; $p = 0.001$) and showed a highest trend towards mortality (5.2% vs. 3.1%; $p = 0.053$). In addition, on-pump surgery was an independent predictor of greater morbidity and mortality (OR 1.58; 95% CI: 1.19-2.1; $p = 0.001$).

The following independent predictors of mortality were identified:

a) Off-pump surgery: female gender (OR 4.4; 95% CI: 2-12).
b) On-pump surgery: age (years) (OR 1.07; 95% CI: 1.03-1.11), diabetes (OR 2.3; 95% CI: 1.8-4.5), LMCA lesion (OR 2.03; 95% CI:1.05-3.93), preoperative kidney failure (OR 2.67; 95% CI: 1.06-6.7), CBP time (minutes) (OR 1.01; 95% CI: 1.002-1.02) and non-elective surgery (OR 1.98; 95% CI: 1.006-3.9).

Valvular surgeries

Aortic valve replacement

A total of 359 surgeries were included. Basal characteristics are displayed in Table 1. Valvular replacement was due to aortic stenosis in 62.7% of procedures and aortic regurgitation in 37.3%. Mechanical heart valve prostheses were used in 59.9% of cases.

In 10.31% of cases the procedures were non-elective; 0.8% were done on an emergency basis.

Mortality was 8.91% (predicted EuroSCORE: 3.51-6.51%). Major complications occurred in 29.3% of cases (Table 2).

The following independent predictors of mortality were identified: CPB time (minutes) (OR 1.01; 95% CI: 1.003-1.02), pulmonary hypertension (systolic pulmonary artery pressure > 35 mm Hg) (OR 4.31; 95% CI: 1.01-18.3) and preoperative kidney failure (OR 5.45; 95% CI: 1.96-15).

Mitral valve surgery

A total of 169 surgeries were included. Basal characteristics are displayed in Table 1. Chronic congestive heart failure was the most frequent clinical presentation (40.2%). Valvular surgery was due to mitral regurgitation secondary to mitral valve prolapse in 34.3% of procedures and rheumatic mitral stenosis in 18.3%.

Left ventricular dysfunction was present in 12.4% of cases. Mechanical heart valve prostheses were used in 58.5% of cases and bioprostheses in 17.2%. Mitral valve repair was performed in 24.3%.

In 9.5% of cases the procedures were non-elective, and 1.2% were done on an emergency basis.

Mortality was 10.6% (predicted EuroSCORE: 3.51-6.51%) and the incidence of complications was 39.6% (Table 2).

Cardiopulmonary bypass time (minutes) was an independent predictor of mortality (OR 1.02; 95% CI: 1.008-1.03).

Combined procedures

A total of 312 patients were included: 248 (79.5%) underwent CABGS associated with AVR and 64 (20.5%) CABGS associated with MVS. Basal characteristics are displayed in Table 1. Left ventricular dysfunction was present in 31.4% of cases.

In 16.3% of patients, there was evidence of severe lesions in the LMCA; 69.5% had lesions in the LAD coronary artery, 51.9% in the LCX coronary artery and 57.1% in the RCA. The median number of grafts was 2 ± 0.95; a LIMA graft to the LAD was implanted in 71.9% of cases.

In 14.4% of cases the procedures were non-elective, and 2.2% were done on an emergency basis. Mortality was 13.4% (predicted EuroSCORE: 3.51-6.51%) and the incidence of major complications was 49.4% (Table 2).

The following independent predictors of mortality were identified: age (years) (OR 1.08; 95% CI: 1.03-1.13), history of congestive heart failure (OR 3.4; 95% CI: 1.5-7.6), CBP time (minutes) (OR 1.014; 95% CI: 1.005-1.023), severe pulmonary hypertension (systolic pulmonary artery pressure > 60 mm Hg) (OR 11.9; 95% CI: 3.1-46) and non-elective surgery (OR 3.4; 95% CI: 1.3-8.4).

DISCUSSION

The XVI CONAREC registry is the result of the necessity of updating the reality of cardiovascular surgery in our country 10 years after the previous registries have been published. Several considerations arise from these findings.

Coronary artery bypass graft surgery

Compared to previous registries, the CONAREC XVI shows that patients undergoing CABGS are slightly older (CONAREC III: 60.9 years; ESMUCICA: 62 years; CONAREC XVI: 63 years), and have a greater prevalence of hypertension, diabetes and comorbidities. In addition, they have better left ventricular function and fewer patients have history of recent myocardial infarction. (Table 3)

Although almost 20% of surgeries were performed on a non-elective basis and 25% of patients presented severe lesions in the LMCA, the use of IABP before was 1.53%. Postoperative low cardiac output syndrome occurred in 23% of patients; however, IABP was used in 3.5% of cases. Evidently, IABP is underused in the preoperative period probably due to lack of availability.

The association of mammary artery bypass grafts with venous grafts is clear. Yet, radial artery grafts were scarcely used.

Mortality rates have decreased across the different studies, probably due to improved surgical techniques and cardiovascular recovery strategies, and to the advent of new drugs. In-hospital mortality was 11.8% in the CONAREC III and 5.1% in the ESMUCICA study, compared to 4.3% in the CONAREC XVI.

Compared to international registries that analyzed almost 6.9 million surgeries in about 20 years (4-23), the profile of the preoperative risk was very similar to our findings yet in-hospital mortality is lower: 2.8% versus 4.3% in CONAREC (Table 5).

There is little information available in the Latin American registries. Mortality rates reported from Chile between 1971 and 1978 in 5000 surgeries and Brazil from 1996 and 1998in 42000 were 1.6% and 7.2%, respectively. (24)

Tabla 3. Comorbidities and mortality. National registries in cardiovascular surgery: CABGS

Comorbidity	III CONAREC registry n = 1.293 41 centers 1992-1993	ESMUCICA n = 1.493 4 centers 1996-1997	XVI CONAREC n = 1.465 49 centers 2007-2008
Hypertension	754 (58.31%)	855 (57.30%)	1.214 (82.80%)
Dyslipemia	744 (57.54%)	956 (64%)	1.006 (68.70%)
Diabetes	272 (21.04%)	325 (21.8%)	446 (30.44%)
COPD	114 (8.82%)	63 (4.20%)	121 (8.26%)
Kidney failure	49 (3.79%)	34 (2.30%)	100 (6.84%)
Unstable angina	853 (65%)	881 (59%)	772 (52.70%)
MI < 30 days	153 (11%)	164 (11%)	110 (7.57%)
Congestive heart failure	64 (4.95%)		111 (7.58%)
Moderate to severe LVD	541 (45.30%)	540 (36.20%)	376 (25.67%)
Non-elective surgery	152 (12.06%)	411 (27.50%)	373 (25.46%)
CBP time		98 min	96 min
Mortality	152 (11.76%)	76 (5.10%)	63 (4.30%)

CABGS: Coronary artery bypass graft surgery. COPD: Chronic obstructive pulmonary disease. MI: Myocardial infarction. LVD: Left ventricular dysfunction. CBP: Cardiopulmonary bypass.

In Argentina, a multicenter study comparing the outcomes of on-pump versus off-pump surgery has never been conducted. Despite our study is a registry that analyzes very heterogeneous populations, off-pump surgery represents a high proportion of all CABGS. Our results show that mortality and major complications are lower in off-pump surgeries, even if perioperative mortality is somewhat greater compared to other international registries (2% at 1month). (4)

It is necessary to perform national prospective and randomized studies to evaluate morbidity, mortality, prognosis and outcomes of patients undergoing CABGS with and without CPB in our country.

Valve surgeries

Compared to the XVI CONAREC registry, patients undergoing AVR and MVS in the ESMUCICA study (3) were younger, had a lower prevalence of comorbidities and non-elective surgeries were more frequent (Table 4).

IN the ESMUCICA study, in-hospital mortality was slightly lower than in the XVI CONAREC registry: 8.3% versus 8.9% in AVR and 9.5% versus 10.65% in MVS. These differences might be due to the selection of the centers and to patients' characteristics.

About 35% of MVS presented postoperative low cardiac output syndrome, even when preoperative left ventricular dysfunction was present in only 12.4% of cases. Ventricular function (evaluated by the ejection fraction) is overestimated in mitral regurgitation; thus, ventricular dysfunction may be present before surgery. After mitral valve replacement, changes in loading conditions occur and the subvalvular apparatus is modified, producing a greater incidence of postoperative low cardiac output syndrome.

Surprisingly, the use of mitral valve repair was low. This might be due to the lack of experience in low-volume surgical centers where mitral valve replacement is the preferred procedure.

Mortality rates reported by international centers are significantly lower than ours: 2.7% for AVR and 6% for MVS; however, the preoperative risk was similar to the one reported in our study (Table 5). (4, 25-27)

Combined procedure

Our study is the first registry in Argentina that has evaluated the clinical characteristics of patients undergoing CP and the surgical outcomes.

We have found that a CP had greater incidence of major complications and mortality compared to isolated surgery. Nevertheless, patients undergoing CP are older than those with pure coronary artery disease or valvular heart disease.

There are 7 international large registries (24) (Table 5). Despite there are no significant differences in patients' basal characteristics, mean mortality was lower than in our study: 7.6% versus 14.9%.

Other considerations

Kidney dysfunction and pulmonary hypertension should be taken into account at the moment of decision-making as they are independent predictors of mortality in several procedures.

Cardiopulmonary bypass time plays an important role to predict mortality; mortality increases by 1% for each minute increase in CBP time.

The EuroSCORE underestimated the real mortality. Perhaps it is time to develop local scores to predict mortality before decision-making.

Table 4. National registries of cardiovascular surgery: valve surgery

	AVR		MVS	
	ESMUCICA n = 241 4 centers 1996-1997	XVI CONAREC n = 359 49 centers 2007-2008	ESMUCICA n = 107 4 centers 1996-1997	XVI CONAREC n = 169 49 centers 2007-2008
Age	58.6	64.8	55.5	59.2
Male gender	151 (62.50%)	227 (63.20%)	36 (34%)	76 (44.90%)
Comorbidities				
Diabetes	22 (9.10%)	63 (17.55%)	6 (5.73%)	14 (8.28%)
Previous stroke	14 (5.90%)	17 (4.74%)	12 (10.93%)	7 (4.14%)
Chronic kidney failure	14 (5.83%)	28 (7.80%)	3 (3.03%)	12 (7.10%)
Congestive heart failure	53 (22%)	99 (27.58%)	23 (21.16%)	68 (40.20%)
Moderate to sever LVD	49 (20.45%)	68 (18.94%)	10 (9.50%)	21 (12.40%)
Non-elective surgery	26 (10.80%)	37 (10.31%)	27 (25%)	16 (9.47%)
CPB time	104 min	92 min	91 min	101 min
Mortality	20 (8.30%)	32 (8.91%)	10 (9.50%)	18 (10.65%)

AVR: Aortic valve replacement. MVS: Mitral valve surgery. LVD: Left ventricular dysfunction. CPB: Cardiopulmonary bypass.

Table 5. Results from the most important international registries of cardiovascular surgery.

Registry	Year	Population (n)	Centers (n)	Region	Type pf surgery	Mortality		
						IH/30 days (%)	1 year (%)	3 years (%)
Caronary artery bypass surgery								
UKCSR	1985-2002	339.000	37	United Kingdom	CABGS	2.5	NA	NA
MEDICARE	1990-1999	629.174	NA	USA	CABGS	NA	NA	NA
CANADA	1995-1998	3.782	4	Canada	CABGS	NA	NA	8.6
CALIFORNIA	1999-2001	82.353	NA	USA	CABGS	2.9	NA	NA
UKCSR	2003	25.277	37	United Kingdom	CABGS	2.2	NA	NA
NACSD	2003	25.832	47	United Kingdom	CABGS	1.9	NA	NA
NEW YORK	2003-2004	7.437	NA	USA.	CABGS	NA	12.4	NA
EACTS	2004-2005	125.553	260	Occ. Europe	CABGS	2.4	NA	7.4
SYNTAX REGISTRY	2005-2007	644	85	USA.-Europe	CABGS	NA	2.5	NA
STS	2000-2008	1.396.361	892	USA.-Canada	CABGS	2.3	NA	NA
Overall analysis		6.864.958			CABGS	2.6	NA	NA
Isolated valve surgery								
UKCSR	1985-2002	92.700	37	United Kingdom	VS	5.4	NA	NA
NACSD	1997-2003	181.677	47	United Kingdom	VS	5	NA	NA
USA. > 65 años	2001	18.333	391	USA	VS	7.5	NA	NA
		19.332	604	USA	VS	8.2	NA	NA
EACTS	2004-2005	26.619	260	Europe	VS	3,6	NA	NA
					AVR	3	NA	NA
					MVS	4.2	NA	NA
STS	2003-2008	95.166	892	USA	AVR	3.2	NA	NA
		25.884			MVS	5.8	NA	NA
		28.637			MVR	1.9	NA	NA
Overall analysis AVR		882.910			AVR	3.7	NA	NA
and MVS					MVS	6	NA	NA
Combined procedures								
UKCSR	1985-2002	37.582	37	United Kingdom	CABGS+VS	8.9	NA	NA
NUEVA YORK	1995-1997	4.201	33	NY-USA	AVR+CABGS	7.1	NA	NA
NUEVA YORK	1995-1997	1.715	33	NY-USA	MVS+CABGS	12.7	NA	NA
NACSD	1997-2003	181.677	47	United Kingdom	CABGS+VS	7.8	NA	NA
UKCSR	2003	3.333	37	United Kingdom	CABGS+VS	7.6	NA	NA
EACTS	2004-2005	16.266	260	Europe	CABGS+VS	6.4	NA	NA
					CABGS+AVR	5.8	NA	NA
					CABGS+MVS	8	NA	NA
STS	1999-2008	129.276	892	USA	CABGS+AVR	5.8	NA	NA
		27.554			CABGS+MVS	11.4	NA	NA
		39.419			CABGS+MVR	7.2	NA	NA
Overall analysis combined procedures		290.232			Combined Procedures	7.60	NA	NA

Modified from Allín JG. (4) UKCSR: United Kingdom Cardiac Surgery Registry. NACSD: National Adult Cardiac Surgical Database Report. EACTS. European Association for Cardio-Thoracic Surgery. STS: Society of Thoracic Surgeons. USA.: United States of America. UK: United Kingdom. NY: New York. CABGS: Coronary artery bypass graft surgery. AVR: Aortic valve replacement VS: Valve surgery. MVS: Mitral valve surgery MVR: Mitral valve repair. IH: In-hospital. NA: Non-available.
Note: The overall analysis includes smaller registries that have note been described in particular. (5-27)

Study Limitations

The participant centers were heterogeneous. In this way, mortality was lower in high-volume centers compared to smaller centers. A future analysis should consider the characteristics of the centers.

In addition, as the participant centers had a cardiology residence program, these results should not be extrapolated to centers without residents.

We considered mortality and major complications when these events occurred during the hospitalization due to surgery. Several international registries define these variables within the first 30 days after surgery. Follow-up at the short-, medium- and long-term is still to be analyzed.

CONCLUSIONS

This registry demonstrates the real facts in cardiovascular surgery in centers with residents in Cardiology.

Mortality and major complications are lower than those reported by previous registers, yet they are still higher than international results. The identification of predictors of poor outcomes should contribute to improve the results.

RESUMEN

Introducción

Los dos grandes registros multicéntricos de cirugía cardíaca realizados en la Argentina,
CONAREC y ESMUCICA, datan de más de 10 años. Considerando los avances médicos y quirúrgicos de la última década, surgió la necesidad de realizar un nuevo registro nacional, prospectivo y multicéntrico para conocer las características, la evolución, las complicaciones y los predictores de mortalidad de los pacientes sometidos a cirugía cardíaca.

Objetivos

Conocer el perfil epidemiológico, la modalidad quirúrgica y la evolución posoperatoria de los pacientes sometidos a cirugía cardíaca en la Argentina.

Material y métodos

Registro prospectivo, consecutivo y multicéntrico realizado en 49 centros cardioquirúrgicos de la República Argentina por residentes de cardiología. Se analizaron las características y la evolución de 2.553 pacientes sometidos a cirugía cardíaca entre septiembre de 2007 y octubre de 2008: 1.465 (57,4%) a cirugía coronaria, 359 (14,1%) a reemplazo valvular aórtico, 169 (6,6%) a cirugía valvular mitral, 312 (12,2%) a cirugía combinada coronariovalvular y 248 (9,7%) a otros procedimientos.

Resultados

Hubo predominio de hombres (74,9%); la edad promedio fue de 63 ± 11 años. La prevalencia de diabetes fue del 24,9%, la de hipertensión del 76,3% y la de insuficiencia cardíaca del 17%. La disfunción ventricular moderada a grave prequirúrgica fue del 23,8% y el 19,8% de las cirugías fueron no programadas. En las cirugías coronarias, el 41,9% de ellas se realizaron sin circulación extracorpórea y se empleó puente mamario en el 89%. El 81,7% de las cirugías mitrales se indicaron por insuficiencia y el 62,6% de las aórticas, por estenosis. En estas cirugías se emplearon válvulas mecánicas en el 58% de los casos. La mediana de internación fue de 6 días. Se presentaron complicaciones mayores en el 31,7% (del 25% en coronarios al 49,36% en combinados) y la mortalidad global fue del 7,7% (del 4,3% en coronarios al 13,4% en combinados).

Conclusiones

Este registro muestra la realidad de la cirugía cardíaca en centros con residencia o concurrencia de cardiología. Comparadas con cifras de registros nacionales previos, la mortalidad y las complicaciones mayores han disminuido, pero continúan siendo elevadas.

Palabras clave > Cirugía cardíaca - Mortalidad - Complicaciones mayores - Predictores de mortalidad

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APPENDIX

Participant centers and CONAREC investigators

Centres with < 50 procedures/year	Investigators
CCI - San Juan	Castilla, Omar; Díaz Mantoani, Marcelo; Trentacoste, Germán
Centro Integral de Trasplante - Buenos Aires	Boullón, Sebastián
Clínica Chutro - Córdoba	Brusain, Facundo
Clínica Regional del Sud - Río Cuarto	Borovina, Ana; Friguerio, Carlos; Puchetti, Ricardo; Sivit, Martín; Villada, Rafael Andrés
H.E.C.A. - Rosario	Palazzi, Lucio
HIGA Alende - Mar del Plata	Contreras Alderete, Sebastián Heberto; Córdova, Maribel
Hospital Argerich - Buenos Aires	Gadea, Francisco José
Hospital Córdoba - Córdoba	Feltes, Gisela; Tosar, Claudia Elina
Hospital Cullen - Santa Fe	Cibils, Mario
Hospital Italiano - Córdoba	Dona, Javier; Espinosa, Gabriel; Gigena, Adriana; Huerta, Clara; Moreno, Pablo; Rojo, Alfredo
Hospital Italiano - La Plata	Corneli, Mariana
Hospital Militar Central - Buenos Aires	Bechara Zamudio, María Paula; Cardus, Marta; Trossero, Romina
Hospital Posadas - Buenos Aires	Ferreyra, Jorge
Hospital San Bernardo - Salta	Barrientos, Natalia
Hospital de Clínicas - Buenos Aires	Chirino, Daniel
Hospital San Juan de Dios - La Plata	Evans, Matilde
ICR - Rosario	Stroppi, Haydee
IMECC - Buenos Aires	Geronazzo, Ricardo
INCOR - La Rioja	Brey, Franco; Cejas, Rubén Ariel; Páez, Cinthia Vanesa; Santander, Pablo Luis
Instituto Cardiovascular SA de Rawson - Chubut	Goddio, Caren Fernanda
Instituto Denton Cooley - Buenos Aires	Heredia, Pablo; Martin, Rodrigo; Musante, Christian Oscar
Instituto Sacre Coeur - Buenos Aires	Allín, Jorge Gustavo; Baucero, Guillermo; Deleu, Marcela; González Naya, Enrique; Valera, Nicolás
Instituto de Cardiología - Tucumán	Burgos, Mario; Chicco Campos, Eleonora; Holownia, Damián; Lizardo, Patricia
N. S. del Rosario - Jujuy	Eleit, Guillermina
POLYMEDIC - La Pampa	García, Alicia Amelia
Sanatorio Delta - Rosario	Franquini, Noelia; Llanes, Paola; Luisetti, Diego; Mata, Lucrecia; Núñez, Leandro; Pierucci, Mariana; Schumacher, Nadina; Senn, Fernando; Zurdo, Paula
Sanatorio de la Mujer - Rosario	Cucurell, Carla
Sanatorio Garat - Concordia	Forte, Ezequiel
Sanatorio Julio Méndez - Buenos Aires	Bonafina, Vanesa
Sanatorio Parque - Rosario	Bustamante, Manuel M.
Sanatorio San Martin - Venado Tuerto	Gómez Vilamajo, Oscar

Centres with > 50 procedures/year	Investigators
Centro Cardiológico del Nordeste - Chaco	Borelli, Evelin; Bruzzo, Juan Cruz; Tirantino, Ariel Alberto; Vázquez, Natalia; Wirz, Fabrizio
CORDIS - Chaco	Correa, Mariana; Delgado, Silvina; Sotnieczuk, Víctor Daniel
CORDIS - Salta	Toldo, Cristian
Clínica Vélez Sarsfield - Córdoba	Corradi, Lucas; Merschon Terrera, Franco Maximiliano; Trejo, Santiago Lucas; Soko, María Micaela
FLENI - Buenos Aires	Carrizo, Laura; Waldman, Silvina
Fundación Favaloro - Buenos Aires	Estofán, Mariano; Garate, María Laura; Gargano, Agustina; Landeta, Federico José; Lowenstein Haber, Diego Maximiliano; Martinenghi, Nicolás; Menichini, Nicolás; Ochoa, Juan Pablo; Pfister, Lisandro; Renedo, María Florencia; Riznyk, Laura; Salinas, Nina; Sciarresi, Esteban; Telayna, Juan Manuel
Hospital Alemán - Buenos Aires	Donato, María Sol; Gambarte, Jimena; Nogués, Ignacio; Rizzo, Natalia
Hospital Británico - Buenos Aires	Pieroni, Pablo Gustavo
Hospital Churruca Visca - Buenos Aires	Grazioli, Gonzalo; Nieves Piazza, Nicolás
Hospital Español - Mendoza	Repetto, Juan Martín; Trucco, Emilce; Seretti Jambor, Italo Bruno
Hospital Naval - Buenos Aires	Guardiani, Fernando Martín; Vázquez, Rodrigo
Hospital Privado - Córdoba	Contreras, Alejandro; Del Corro, Irene; Illanes, Valeria; Ferrero Guadagnoli, Adolfo; Ferro, Luciana; Morillo, David
Hospital Universitario UAI - Buenos Aires	Pérez Baztarrica, Gabriel; Sánchez, Fabio
Instituto Cardiovascular del Sur - Río Negro	Cari, Martín; Valenzuela, Gabriela Marisel; García, Pablo; Ferreyra, María Constanza; López Cross, Alejandro; Martin, Iván; Martínez, Juan Manuel
Instituto Modelo de Cardiología - Córdoba	Actis Alesina, Juan Miguel; Olmedo, Julián Andrés
Instituto de Cardiología Juana A. Cabral - Corrientes	Fleitas Páez, Maximilano; Lange, Juan Manuel; Laurino, Romina Paola; Olivera, Guillermo Damián; Villegas, Esteban Daniel; Zoni, César Rodrigo
Sanatorio Güemes - Buenos Aires	Provera, Hernán; Sosa, Ariel Raúl
Sanatorio Mitre - Buenos Aires	Lograzo, Emilio Ariel; Pérez, Gonzalo; Rosende, Andrés