ORIGINAL ARTICLE

Survival, Clinical Status, and Quality of Life Five Years After Coronary Surgery. The ARCA Study

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Introduction and objectives. Little is known about the long-term outcomes of coronary surgery and their determinants in Spain. The objectives of this study were to evaluate clinical outcomes, quality of life and survival in a cohort of patients 5 years after undergoing a first aortocoronary bypass operation without any other associated procedure.

Methods. Patients who survived the operation and whose pre- and postoperative data had been collected prospectively were followed up by telephone interview after 5 years.

Results. Information was available after 5 years on 1300 (85.2%) of the 1525 patients who survived until hospital discharge. Of these, 13.6% had died, while 24% had either died, undergone revascularization or were readmitted because of a cardiac complaint. The cumulative survival rate (excluding the period of hospitalization) was 0.87 (95% confidence interval, 0.85-0.89). Mortality varied significantly with the level of preoperative risk (ie, the EuroSCORE), to the extent that mortality in the low-risk group was equivalent to that in the general reference population.

Conclusions. Three-quarters of patients who survived until hospital discharge after coronary surgery did not experience a major cardiac event within 5 years and their level of functioning and quality of life were good. The survival rate after the immediate postoperative period varied according to the patient's preoperative risk profile and, in low-risk patients, was equivalent to that in the general reference population.

Key words: *Aortocoronary artery bypass graft. Surgery. Survival. Quality of life.*

Supervivencia, estado clínico y calidad de vida a los cinco años de la cirugía coronaria. Estudio ARCA

Introducción y objetivos. El resultado tardío de la cirugía coronaria y sus determinantes son poco conocidos en España. Este estudio evalúa la evolución clínica, la calidad de vida y la supervivencia de una cohorte de pacientes, transcurridos 5 años de un primer injerto aortocoronario sin otros procedimientos asociados.

Métodos. Seguimiento telefónico a los 5 años a los supervivientes de la operación, de los que se había recogido prospectivamente los datos preoperatorios y postoperatorios.

Resultados. De los 1.525 pacientes dados de alta vivos, a los 5 años se obtuvo información de 1.300 (85,2%), de los que el 13,6% había fallecido y el 24% había fallecido o había sido revascularizado o ingresado por causa cardiaca. La supervivencia acumulada (excluyendo la fase hospitalaria) fue de 0,87 (intervalo de confianza [IC] del 95%, 0,85-0,89). La tasa de mortalidad fue distinta según el riesgo preoperatorio (EuroSCORE); la del grupo con bajo riesgo fue equivalente a la de la población general de referencia.

Conclusiones. De cada 4 supervivientes al alta 3 están libres de eventos mayores a los 5 años, con buenas capacidad funcional y calidad de vida. La supervivencia después del postoperatorio inmediato varía en función de las características prequirúrgicas de riesgo y en el grupo con bajo riesgo es equivalente a la de la población general de referencia.

Palabras clave: *Injerto aortocoronario. Cirugía. Supervivencia. Calidad de vida.*

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INTRODUCTION

The hospital results of coronary surgery and their determinants are well known due to the presence of numerous registries, some of which have enabled the development of risk prediction models for in-hospital mortality.[1,2]

Although abundant information is available on survival several years after coronary surgery,[3-10] not so much is available in Spain[11] and there is even less on the clinical outcome and quality of life. Moreover, few studies have compared survival with a reference population from the same geographical area.[10]

The ARCA Study[12] examined the hospital results in a cohort of patients who underwent a first isolated coronary artery bypass procedure in the Catalan public health system, analyzing the influence of the type of management of the providing center. This study involved a 5-year follow-up of the same cohort in order to analyze: *a)* the clinical evolution and the quality of life of the survivors; *b)* the late survival according to the preoperative risk (assessed with the EuroSCORE) compared with the survival of the general population in the same geographical area; and *c)* the factors determining survival. In addition, the effect of the type of management of the center on the 5-year prognosis was also analyzed.

METHODS

The strategy used for data collection has been described previously.[12] Briefly, data were recorded prospectively on all the patients covered by the public health system in whom an isolated coronary artery bypass graft was indicated as first surgery, from October 2001 to October 2003, at 3 publicly managed hospitals and 2 privately managed hospitals. The study was approved by the ethics committee of the coordinating center.

Follow-up

The Catalan Mortality Registry (available up to December 2005) (Registre de Mortalitat de Catalunya, Servei d'Informació i Estudis, Direcció General de Recursos Sanitaris, Departament de Salut) and the computerized registries of the hospitals were consulted to obtain information about the vital status of the patients. All the patients not identified as dead were contacted by telephone approximately 5 years after surgery.

The follow-up was done by a member of the Cardiology or Cardiac Surgery Services of the center or by an outside person specially trained for the purpose (Projecta'm Company). The follow-up consisted of a structured interview about the clinical status (angina and functional class), events occurring since surgery (readmission for any cause, visits to the emergency department, catheterizations and the need for further revascularization) and the health-related quality of life using the SF-12 v2 survey.[13,14] The hospital events were confirmed by checking the computerized hospital registries.

The classification of functional class was made according to the Canadian Cardiovascular Society,[15] with the following modifications: *a)* class 0 was used for all patients who did not have angina or limitations in their normal life due to other types of symptoms or for personal decisions; and *b)* the functional class was recorded at the time of the interview based on the limitations in activities of daily living due to any type of symptoms (angina or other causes) or as a personal decision.

The SF-12 v2 is a shorter version of the SF-36 and is designed for use when the latter may be too long.[16] It has been adapted for use in the Spanish population[17] and consists of 12 items from which scores can be calculated on 8 dimensions of health. The scores were compared with the values adjusted for the age and sex of the general Spanish population[17] and the summary physical component score (PCS) and the mental component score (MCS) were calculated, standardized for the general Spanish population (mean, 50 [10]).[17] The scores ranged from 0 to 100, with 100 being the best perceived quality of life.

Statistical Analysis

The preoperative risk was estimated from the logistic EuroSCORE model.[18,19] Survival during the follow-up was estimated for the whole population and for the various subgroups of risk, according to the EuroSCORE (low: from 0 to 2; moderate: from 2 to 5; and high: greater than 5) and in the 2 groups of patients who underwent surgery in publicly or privately managed hospitals, using Kaplan-Meier curves. The data were censored for the date of last contact in those patients who could not be located telephonically, with the information about their vital status obtained from the hospital registries.

The expected rates were calculated for each age and sex group in the study cohort, assuming a constant mortality rate the same as that of the general population in Catalonia in 2005[20] for the whole follow-up period (from October 2001 to February 2008).

For the study of factors determining survival, patients who had died during the immediate postoperative period were eliminated, as the mortality rates differ between the hospital phase and after discharge.[21] The relation was analyzed between the potential prognostic variables, both preoperative and immediate postoperative variables, and survival. Data considered included sex, age,

history of stroke and heart failure, common trunk or 3-vessel disease, peripheral vascular disease, recent myocardial infarction, urgent indication (the patient underwent surgery during the same admission for acute coronary syndrome) or emergency indication (within the first 24 h of the indication), unstable angina (need for intravenous nitrates up to the time of surgery), previous functional class, left ventricular dysfunction, chronic obstructive pulmonary disease, renal insufficiency, preoperative critical status, cardiovascular risk factors, variables related with the procedure (use of extracorporeal circulation, multiple grafts, use of mammary, radial or saphenous graft), complications during the immediate postoperative period (postoperative infarction or postoperative infection), and type of management of the center.

A Cox regression model was constructed selecting the variables related with survival with a statistical significance <.1 in the log-rank test. The variables selected were included in the model, keeping all those with a $P<.2$.

The assumption of proportional risk was evaluated using the Schoenfeld residuals test, which was significant for the variable type of management ($P=–0.2$; $P=.01$). Graphs were used to show a change in the proportionality of risks after approximately 6 months of follow-up, so an extended Cox model was made incorporating a function time—$g_{(t)}$: Heaviside function—to obtain 2 different estimations of the hazard ratio (HR) for the type of management (private compared with public), one for the period between discharge and 6 months and the other for the period after 6 months.[22] The function of risk—$h(t,X_{(t)})$—for the simpler extended Cox model (with just 2 independent variables X_1 and X_2) was the following, where t_0 is the baseline time and $h_{0(t)}$ the baseline risk at time t:

$$h(t,X_{(t)})=h_{0(t)}\exp[\beta_1X_1+\beta_2X_2+\Delta X_2\times g_{(t)}]$$

Where $g_{(t)}=0$ if $t\leq t_0$ and $g_{(t)}=1$ if $t>t_0$; from which we obtain 2 different HR for the variable X_2: when $t\leq t_0$, $HRx_2=EXP[\beta_2]$, and when $t>t_0$, $HRx_2=EXP[\beta_2+\Delta]$.

RESULTS

The study included 1602 patients, whose hospital mortality was 4.8% (95% CI, 3.8-6); 1525 were therefore eligible for the follow-up study. Tables 1 and 2 provide a summary of the baseline characteristics of these patients.[12]

The rate of loss to follow-up at 1 year was 5.4% and for 5 years it was 14%. The 225 patients who could not be located at the 5 year follow-up differed from those who were located in that they were younger (mean age, 63 vs 65 years) and had a lower preoperative risk (mean EuroSCORE, 3.4 vs 4.3). The mean follow-up period in the patients who were discharged alive was 4.9 (1.2-6.2) years.

TABLE 1. **Preoperative Characteristics of the Study Population (n=1602)**

Demographic data and cardiovascular risk	
Age, mean (SD), y	64.8 (9.9)
Older than 75 years	205 (12.8)
Women	315 (19.7)
Diabetes mellitus	636 (39.9)
Hypertension	1005 (63.2)
Hypercholesterolemia	1049 (66.4)
Variables related with surgery	
Use of mammary artery graft	1511 (94.4)
Use of radial artery graft	253 (16.4)
Use of saphenous vein graft	1383 (86.93)
Number of grafts	
2	492 (32.1)
3 or more	919 (59.9)
Surgery without extracorporeal circulation	705 (44.1)
Factors determining surgical risk	
Common trunk involvement	445 (27.8)
Three-vessel involvement	1119 (69.9)
Indication	
Urgent	822 (51.5)
Emergency	19 (1.2)
Recent myocardial infarction (up to 90 days before surgery)	414 (25.8)
Unstable angina (intravenous nitrates)	193 (12.1)
Functional class according to the CCS classification	
I	37 (2.3)
II	964 (60.4)
III	379 (23.7)
IV	212 (13.3)
Left ventricular dysfunction	
Mild (30%-50%)	347 (22.5)
Severe (<30%)	66 (4.3)
History of heart failure	179 (11.2)
History of stroke	116 (7.3)
Neurological deficit	38 (2.6)
Peripheral vascular disease	403 (25.2)
Chronic obstructive pulmonary disease	248 (15.5)
Renal failure (creatinine >2.26 mg/dL)	26 (1.7)
Risk according to EuroSCORE	
Low (0-2)	650 (40.6)
Moderate (2-5)	544 (34)
High (>5)	408 (25.5)
Expected mortality (logistic EuroSCORE)	
Mean (95% CI)	4.2 (3.9-4.4)
Median [interquartile range]	2.5 [1.3-5.1]

CCS indicates classification of functional class according to the Canadian Cardiovascular Society, but applied to hospital patients: *a)* functional class IV if patient had angina at rest during previous 72 h; *b)* functional class III if patient had angina at rest before previous 72 h and remains in bed or if during the admission patient had angina during mild hospital activities; and *c)* the others were classified as functional class II; CI, confidence interval; SD, standard deviation.
The data are expressed as n (%) unless otherwise stated.

TABLE 2. **Events During the Immediate Postoperative Period (n=1602)**

Hospital mortality	77 (4.8)
Mortality at 30 days	80 (5)
Bleeding	103 (6.5)
Postoperative myocardial infarction	124 (7.8)
Reoperation	56 (3.5)
Infectious complications	154 (9.7)
Cardiovascular complications	171 (10.7)
Noncardiovascular complications	190 (11.9)

The data are expressed as n (%).

Survival, Clinical Status, and Quality of Life During the Follow-up

Of the 1602 patients who underwent surgery, 254 died (77 during the hospital phase), which represents a total of 6363 years at risk; the last event was seen at 6.2 years. The accumulated survival (including the hospital phase) at 6 months was 0.94 (0.92-0.95) and at 5 years it was 0.83 (0.81-0.85). Of the 1525 patients discharged alive, 177 died during the follow-up, representing a total of 6359 years at risk. The accumulated survival (excluding the hospital phase) during the follow-up at 6 months was 0.99 (0.98-0.99) and at 5 years it was 0.87 (0.85-0.89); the rate of major event free survival (death or new revascularization) at 5 years was 0.84 (0.82-0.86).

A significant difference was seen in the mortality rates between the patients with a low, moderate or high preoperative risk, according to the EuroSCORE (Figure 1). During the period after discharge (Figure 1A), the mortality rate in the high-risk group was greater than expected. Figure 1B shows that the greater mortality in the high-risk group was mainly due to the hospital mortality and to that during the period immediately after (up to approximately 1 year after discharge). The mortality rate (including the hospital phase) in the low-risk group was almost the same as expected (Figure 1B).

Table 3 presents the rates of events in the 1300 patients with a complete follow-up. Of those who were discharged alive, 24% died, were revascularized or readmitted for cardiac causes. Of the 986 patients with no major cardiac events, 291 (29.5%) were admitted for a non-cardiac cause or attended the emergency department for chest pain.

Of the 1123 patients who were located alive, 1056 (94%) answered the telephone interview. Their clinical status and quality of life are shown in Table 4. Sixteen percent had unstable angina (23% were in functional class III or IV) and 6.8% of those who did not have angina had moderately or severely limited activity (functional class III or IV) for other symptoms. Figure 2 shows the quality of life profile at the time of interview according to the functional class. The patients with moderate or severe limitation for whatever cause (10% of the patients interviewed classified in functional class III or IV) had problems with some health dimensions (especially physical function), whereas the others had a quality of life that was equivalent to that of the general Spanish population. Of the patients alive at discharge, 75.8% had survived without requiring further revascularization and with no important physical limitations (functional class 0, I, or II), with an equivalent quality of life to that of the general population (median [interquartile range], 48 [41-55]).

TABLE 3. **Events During the Follow-up Period in the Patients Located at 5 Years**

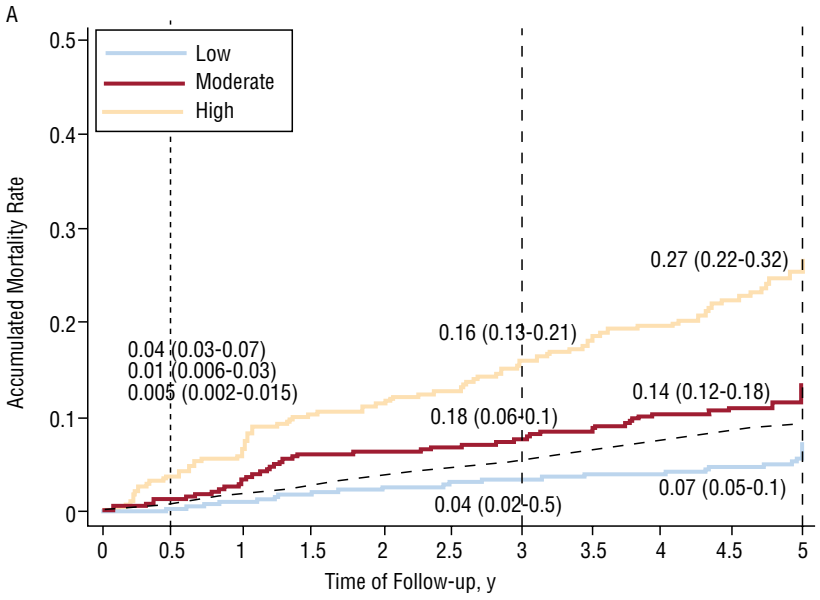
Mortality and major cardiac events	1300
Mortality	177 (13.6)
Admitted due to cardiac cause	149 (11.5)
Acute myocardial infarction	37 (2.8)
Angina	85 (6.5)
Heart failure	42 (3.2)
Need for further revascularization	53 (4.1)
Percutaneous	48 (3.7)
Surgical	8 (0.6)
Death or admission due to cardiac cause or need for further revascularization	314 (24.2)
Admitted for other causes	248 (19.1)
Emergency presentations	181 (13.9)
Catheterisations	122 (9.4)

The data are expressed as n (%).

TABLE 4. **Incidence of Angina, Functional Status, and Health-Related Quality of Life of the Survivors Who Responded to the Telephone Interview (n=1056)**

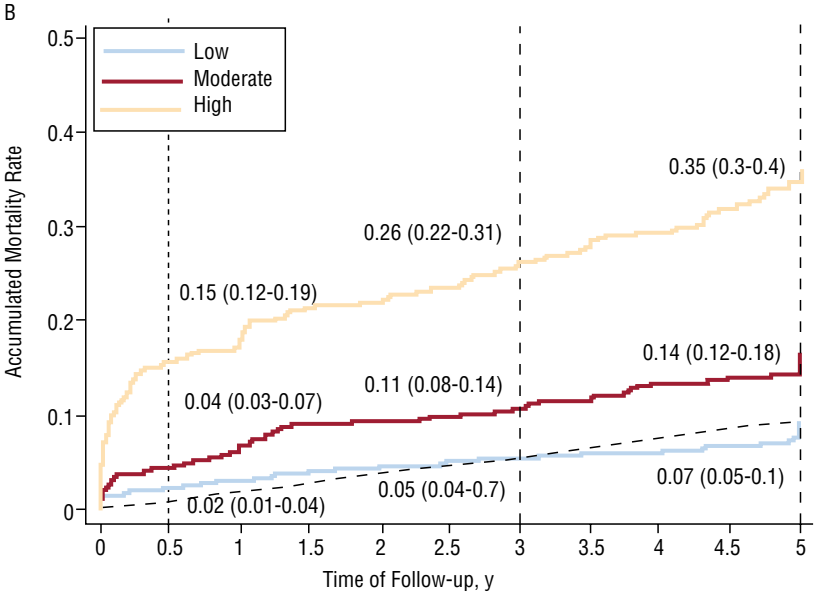
Unstable angina	179 (16)
Functional angina class according to the CCS	
I	38 (21.8)
II	96 (55.2)
III	37 (21.3)
IV	3 (1.7)
Limitation in activity due to other causes[a]	
0	417 (44.9)
I	245 (26.4)
II	203 (21.9)
III	58 (6.3)
IV	5 (0.5)
Scores on the SF-12 (version 2)	
PCS, mean (SD)	45.3 (11.1)
MCS, mean (SD)	53.3 (10.3)

CCS indicates classification of the functional class based on the Canadian Cardiovascular Society Classification; MCS, mental health component summary score; PCS, physical health component summary score; SD, standard deviation.
[a]In the event that the patients have a life limited by symptoms of another type or due to personal choice, the functional class was also classified according to the CCS adding the class 0 when there were no limitations.
The data are expressed as n (%) unless otherwise stated.



Total Number of Patients in Risk:

Discharge	1 y	2 y	3 y	4 y	5 y
1525	1481	1333	1180	1.20	558



Total Number of Patients in Risk:

Readmit	Discharge	1 y	2 y	3 y	4 y	5 y
1602	1525	1481	1333	1180	1120	558

Figure 1. A: accumulated mortality rate after hospital discharge (excluding hospital mortality) according to the preoperative risk (EuroSCORE). The dashed line corresponds to the expected mortality according to the reference population and the figures indicate the estimation of the accumulated mortality rate at 6 months and at 3 and 5 years. Log rank test, 71.4 ($P<.0001$). B: accumulated mortality rate after the operation (including hospital mortality) according to the preoperative risk (EuroSCORE). The dashed line corresponds to the expected mortality according to the reference population and the figures indicate the accumulated mortality rate at 6 months and at 3 and 5 years. Log rank test, 131.1 ($P<.0001$).

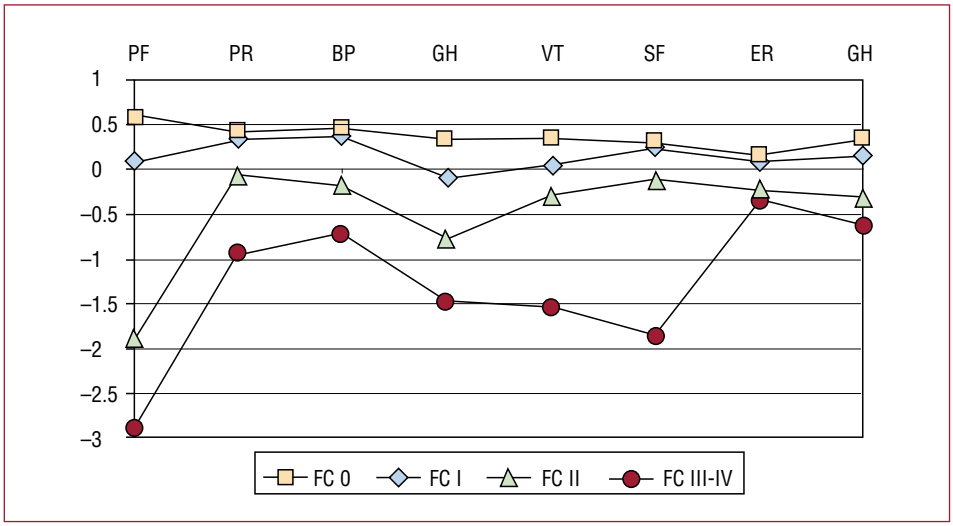


Figure 2. Mean scores of the 8 dimensions of the SF-12 in the follow-up according to the functional class and relative to the mean scores of the Spanish reference population adjusted for age and sex (value 0). The y axis indicates the difference with the reference value in the number of standard deviations. BP indicates body pain; ER, emotional role; FC, functional class; GH, general health; MH, mental health; PF, physical function; PR, physical role; SF, social function; VT, vitality.

TABLE 5. **Predictors of Mortality During the Follow-up of the Survivors to Hospital Discharge Using a Cox Model With Time-Dependent Variables (Valid Population, n=1525)**

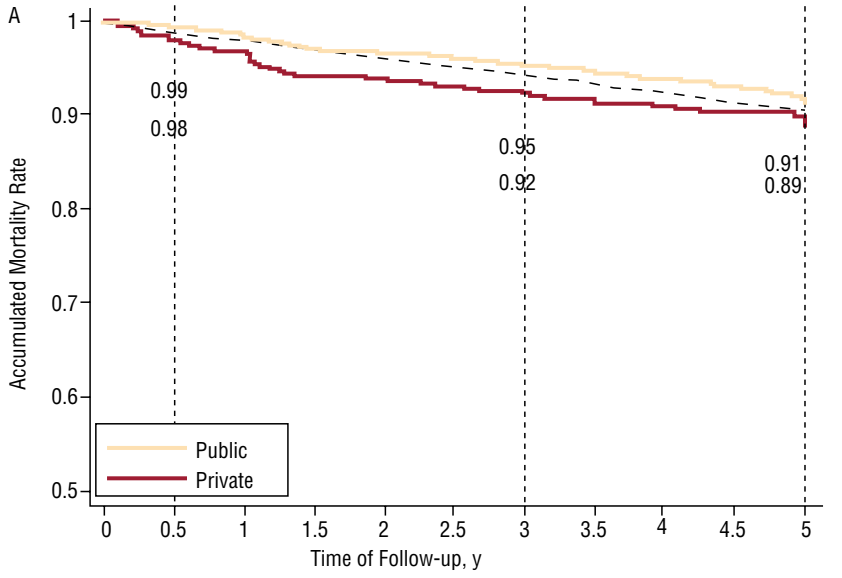
	HR (95% CI)	*P*
Age	1.04 (1.02-1.06)	<.001
History of heart failure	2.03 (1.39-2.98)	<.001
History of stroke	1.65 (1.07-2.56)	.024
Peripheral vascular disease	1.93 (1.41-2.64)	<.001
Common trunk disease	1.39 (1.02-1.89)	.036
Surgery without extracorporeal circulation	0.93 (0.67-1.27)	.635
Preoperative critical status	2.43 (1.29-4.57)	.006
Ventricular dysfunction		
Moderate	1.28 (.91-1.82)	.159
Severe	2.13 (1.19-3.81)	.011
Postoperative infection	1.37 (.88-2.12)	.161
Private management of the center (up to 6 months)[a]	2.73 (1.21-6.14)	.015
Private management of the center (with effect from 6 months)[b]	1.14 (0.21-6.22)	

[a]The HR for mortality for private management as compared with public management between hospital discharge and 6 months of follow-up was: EXP(1004) = 2.73.
[b]The HR for mortality for private management as compared with public management with effect from 6 months was obtained from $\beta_{(\text{private management})} = 1.004$ (*P*=.015) and $\beta_{(\text{private management} \times t)} = -0.87$ (*P*=.053) using the equation: $\text{EXP}_{(1.004 - 0.87)} = 1.14$.

Determinants of Mortality During the Follow-up

In the patients who survived the operation, the age, a history of heart failure and stroke, peripheral vascular disease, a critical preoperative status, common trunk disease, and a depressed ventricular function were independently associated with a higher mortality rate at 5 years (Table 5). Complications during the immediate postoperative period were not significantly associated with mortality during the follow-up.

Although having undergone surgery at a privately managed center was an independent predictor of greater risk in the interval from hospital discharge to 6 months after the surgery (HR=2.73; 95% CI, 1.21-6.14), this association disappeared with effect from the 6 months, and the risk was similar in both groups (HR=1.14; 95% CI, 0.21-6.22). Figure 3 shows the survival adjusted for the preoperative risk in both groups with effect from hospital discharge and with effect from surgery. As can be seen in Figure 3A, as the hospital mortality rates were higher in the public hospitals and the mortality rate during the first 6 months post surgery was higher in those who underwent surgery at the private hospitals, the overall mortality up to 5 years was similar in both groups. Likewise, it can be seen that the mortality rate was not different to the expected and that the greater mortality in the cohort who underwent surgery can be attributed to the hospital phase and the phase immediately after (Figure 3B) and it equates with the expected mortality at approximately 4 or 5 years.



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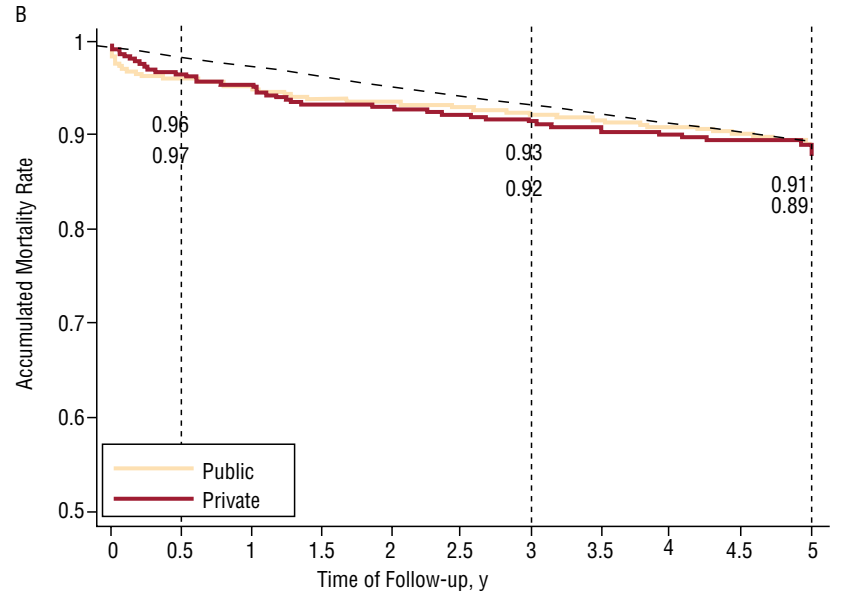

Total Number of Patients in Risk:

Readmit	Discharge	1 y	2 y	3 y	4 y	5 y
1602	1525	1481	1333	1180	1120	558

Figure 3. A: accumulated survival from hospital discharge (excluding hospital mortality) according to the type of management of the center, adjusting for the preoperative risk. The dashed line corresponds to the expected survival according to the reference population and the figures indicate the estimation of the accumulated mortality rate at 6 months and at 3 and 5 years. Log rank test, 4.73 (*P*=.03). B: accumulated survival with effect from surgery (including hospital mortality) according to the type of management of the center, adjusting for the preoperative risk. The dashed line corresponds to the expected survival according to the reference population and the figures indicate the estimation of the accumulated mortality rate at 6 months and at 3 and 5 years. Log rank test, 1.31 (*P*=.25)

DISCUSSION

This study provides information on the survival, clinical status and quality of life of a cohort of 1602 consecutive patients from 5 Catalan hospitals 5 years after having undergone a first coronary artery bypass graft. The study provides relevant information on the influence on the late result of the preoperative status, the surgical risk as assessed by a standard instrument

and the type of management (public or private). Considering the characteristics of the participating centers,[12] it is plausible that our results are valid for most other centers that carry out coronary surgery in Catalonia and the rest of Spain.

Events, Clinical Status, and Quality of Life

Approximately three quarters of those who survived to discharge survived to 55 years with a good clinical status, good quality of life, and free of major events. In agreement with the results of an earlier study[23] undertaken in the same context, most of the limitations in activities of daily living were due to causes other than the angina.

Survival According to Baseline Risk Compared With the General Reference Population

The rate of late mortality was equivalent to that found in other series.[4,21] The analysis using the mortality in the general population from the same geographical area as a reference provides an approximation to the so-called "relative survival."[24] This approximation, much used in studies on cancer, may prove useful in cardiovascular disease, and more especially in coronary surgery,[10,24] as it permits the proportion of mortality associated with the condition of interest to be differentiated from the overall mortality without requiring the specific cause of death to be known. This study enabled us to see that the major mortality associated with coronary surgery is found in those patients with a high preoperative risk and during the immediate postoperative period or during the initial months after hospital discharge. After this, the mortality rate is no different to that of the general population. A similar result was found in the study by Stahle et al,[10] who stratified the patients into groups of varying risk according to the preoperative ejection fraction.

Determinants of Survival

This study provides interesting data on the possible usefulness of the determining factors collected in the tools to measure the surgical risk in order to predict the late risk. The EuroSCORE, although initially designed to predict hospital mortality, is also useful to stratify the patients according to their long-term prognosis[25] for both survival[26] and quality of life.[27] This was expected, as some of the preoperative variables used for the calculation also predict late mortality. However, some determinants of hospital mortality may not be so for survival of those patients who survive the operation.[21,28]

The prognostic variables for 5-year mortality, with the exception of the preoperative clinical status, are related more with the chronic cardiovascular disease of the patient (age, history of heart failure and stroke, peripheral vascular disease, ventricular dysfunction)[3-10,21] than with the immediate preoperative status (urgent or emergency situation, preoperative unstable angina or infarction), which were the most important predictors of hospital mortality.[12] This agrees with the results of another study[23] in which the presence of concomitant diseases was an important predictor of 1-year mortality. Disease of the common trunk may also be an indicator of more severe arteriosclerotic disease. On the other hand, the situation during the immediate postoperative period has no significant impact on late mortality. As with other series,[9] surgery without extracorporeal circulation, which during the hospital phase is associated with a lower risk of death and complications,[29] was not significantly associated with late mortality.

Influence of the Type of Management

The study of hospital mortality found differences between the centers according to whether they were managed privately or publicly.[12] These differences were not confirmed over the longer term, as mortality increased after hospital discharge in the cohort of patients who underwent surgery at private centers (the variable private management of the center is a predictor of major mortality at 6 months), such that the survival rates adjusted for the 2 types of center equaled out over the short term. The present study does not permit identification of the reasons for this finding, but it raises important questions about the care process in the 2 types of center, which should be the subject of further more detailed studies. This fact highlights the importance of considering the results over a longer term (at least 6 months), and not just hospital mortality, when the aim of the analysis is to assess the quality of care or compare different providers. The type of analysis used (an extended Cox model using time-dependent variables) enabled us to study this change in the rate of survival over the short and long terms.

Study Limitations

The main limitations of this study concern the rate of losses to follow-up and those inherent to the methods used for the survival analysis. The loss rate was 14% at 5 years. Although most of this occurred after the first year (the loss rate at 1 year was 5.4%), a period during which the likelihood of events related with the operation is greater, we cannot rule out the possibility of underestimating the later survival (the patients who were lost were younger and had less risk). On the other hand, most of the patients who

were located but did not respond to the telephone interview (5.2%) were in institutions or had important accompanying disorders. Accordingly, the evaluation of the clinical status in the survivors may be partly influenced in opposite directions by these 2 facts. It should be taken into account that the mortality of the general population includes that of the study patients.[24] Nevertheless, the proportion of patients who have undergone coronary artery bypass surgery in the general population is relatively low. Secondly, a cohort of patients who have undergone coronary artery bypass surgery have a greater prevalence of non-cardiac vascular disease and cardiovascular risk factors than the general population (due to their underlying disorder). Thus, any comparison should be made with caution, bearing in mind that the 2 populations are comparable concerning age, sex and the prevalence of disorders not related with the arteriosclerotic disease, but not concerning any accompanying disorder related with the ischemic heart disease. Finally, the calculation of the expected mortality was done from that seen in Catalonia 2005, whereas the study cohort was followed-up between 2001 and 2008. Nonetheless, it is unlikely that the mortality rates for the general population have experienced large changes in this period, as, although they tend to fall over time,[20] this fall is of little importance in a period of just 6 years.

In spite of these limitations, comparison with a reference population provides clinically relevant information about the long-term prognosis and should be considered in observational studies that do not have a suitable group available for comparison.

CONCLUSIONS

This study shows that patients who undergo a first coronary surgery procedure in Catalonia have an acceptable 5-year prognosis: approximately three quarters of patients who survived to discharge are alive, with no major events, with a good functional capacity and quality of life equivalent to that of the general Spanish population. Survival rates beyond the immediate postoperative period and in the group with a low preoperative risk were similar to that of the general reference population. Moreover, the mortality rate varied according to the preoperative risk characteristics (as per the EuroSCORE) and the type of management, which had an influence on hospital mortality but not on longer-term mortality.

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