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Eighteen-year follow-up demonstrates prolonged survival and enhanced quality of life for octogenarians after coronary artery bypass grafting

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Objective: Octogenarians comprise the fastest growing population segment. Numerous reports have documented improved accomplishment of coronary artery bypass grafting in this high-risk cohort. But what is the quality of life after surgery, and how sustainable are the clinical benefits?

Methods: Sequential cross-sectional analyses were performed on 1062 consecutive patients 80 years old and older who underwent isolated on-pump coronary artery bypass grafting at a single institution from 1989 to 2001. After mean follow-up of 3.4 years (1 month–12.6 years), the Short Form 36 quality of life survey was administered to all survivors. Late follow-up for survival was performed after a mean 5.6 years (1 month–17.9 years). Multivariate analyses assessed risk factors associated with operative mortality, Short Form 36 self-assessment, and late survival.

Results: Mean age at operation was 83.1 ± 2.8 years (range, 80–99 years). Overall in-hospital mortality was 9.7%, decreasing progressively to 2.2% during the course of the study. At midterm follow-up, 97.1% of patients were in Canadian Cardiovascular Society class I or II; Short Form 36 scores were comparable to age-adjusted norms in both physical and mental health summary scores. Actuarial survivals were 42.2% ± 1.5% at 7 years and 9.9% ± 1.4% at 14 years. Median survival was 5.9 years; 5.2 years for male patients and 6.7 for female patients (P =.004).

Conclusions: The risk of coronary artery bypass grafting for octogenarians now rivals that of a younger population. Midterm quality of life and long-term survival approach those of the general population. (J Thorac Cardiovasc Surg 2011;141:394-9)

Supplemental material is available online.

Elderly persons represent the fastest growing segment of the population. It is projected that the number of citizens older than 75 years will quadruple in the next 50 years.[1] Nearly 40% of octogenarians have symptomatic cardiovascular disease, which accounts for more than half of the mortality in this age group.[2] Multiple series have demonstrated the ability to perform cardiac surgery on this cohort with elevated but improving mortality and morbidity.[3,4] The key questions that must be addressed are as follows: (1) Do the relief of symptoms and improvements in functional status and quality of life (QOL) warrant the increased risk and expense of surgical therapy in this more fragile elderly population? (2) How sustainable are the clinical benefits? To address these issues, sequential cross-sectional follow-up was conducted consisting of a large cohort of patients 80 years old and older from a single community surgical practice who underwent isolated coronary artery bypass grafting (CABG) for symptomatic coronary artery disease.

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MATERIALS AND METHODS

For definitions of terms, see online Appendix E1. This report involves 1062 consecutive patients 80 years old and older who underwent isolated CABG between January 1989 and December 2001. Waiver of informed consent to conduct the study was obtained from the institutional review board. There were 651 men (61.3%) and 411 women (38.7%), with a mean age of 83.1 ± 2.8 years (range, 80–99 years). The coronary and perioperative risk factors and coronary angiographic findings documented in the series are summarized in Table 1.

A patient's preoperative anginal symptoms were as defined by the Canadian Cardiovascular Society (CCS). Patients with unstable angina included those with CCS class III or IV symptoms. There were 64 patients (6.0%) in class II, 502 patients (42.3%) in class III, and 496 patients (46.7%) in class IV.

Operative Data

The operation was performed electively in 832 cases (78.3%), urgently in 162 cases (15.3%) and on an emergency basis in 68 cases (6.4%). A total

Abbreviations and Acronyms

CABG = coronary artery bypass grafting
CCS = Canadian Cardiovascular Society
ITA = internal thoracic artery
PCI = percutaneous coronary intervention
QOL = quality of life
SF-36 = Short Form 36

of 3884 coronary artery grafts were performed (mean, 3.7 per patient; range, 1–6). The left internal thoracic artery (ITA) was used for grafting in 442 cases (41.5%), and its use increased during the course of the study. All operations were performed with the assistance of cardiopulmonary bypass, moderate hypothermia, aortic crossclamping, and cold sanguineous cardioplegic arrest. The mean cardiopulmonary bypass time was 61.2 ± 21.7 minutes (range, 10–240 minutes), and the mean aortic crossclamp time was 31.7 ± 15.8 minutes (range, 4–140 minutes).

Data Collection and Management

Perioperative data were obtained by prospective review of each patient's hospital record, catheterization reports, cinematic angiograms, and echocardiography. Follow-up information was obtained through comprehensive questionnaires and by telephone interviews with surviving patients, their family members, or their personal physicians. Follow-up data included activity level, current symptoms, diagnostic tests, occurrence of late cardiac events, medications being taken, and an assessment of QOL. Moreover, patients were asked to describe their anginal status and were ranked according to the CCS classification system.

A patient registration form and a patient follow-up form were completed for each patient in the study at the time of midterm follow-up. These data collection instruments provided standardized reporting of each patient's clinical status before and after the operation. When patients could not be located, the Social Security Death Index database (available at http://genealogy.rootsweb.com) was used to obtain patient mortality information. The capability to identify deaths in the Social Security Death Index is between 92% and 99% according to the unique identifiers available.[5]

QOL assessment was conducted with the Short Form 36 (SF-36) developed by Ware and associates.[6] The SF-36 is a standardized instrument comprised of 36 items designed to measure 8 dimensions of overall health and 2 summary components, a physical health score and a mental health score.

Cross-sectional follow-up was performed in 2001 and included the patient's clinical status and QOL assessment. A second cross-sectional analysis with the Social Security Death Index was conducted in 2007 regarding survival status. Patients who could not be contacted during the course of the study through various means or were not identified in the Social Security Death Index were documented as unavailable for follow-up. A 98.6% follow-up was obtained with 15 patients unavailable for follow-up.

Statistical Analysis

Data are presented as frequency distributions and simple percentages. Values of continuous variables are expressed as mean ± SD. Univariate analysis of selected preoperative and postoperative discrete variables was accomplished by χ^2 test, the continuity-adjusted χ^2 analysis, or a 2-tailed Fisher's Exact test, with the appropriate degrees of freedom to test for the equality of proportions in the case of categorical variables. Two-sample Student *t* tests (2-tailed) were used to test for the equality of the means of continuous variables. To identify predictors of hospital mortality, a multivariate analysis by forward stepwise logistic regression of preoperative and intraoperative variables was performed. For a listing of covariates used to predict in-hospital mortality, see online Appendix E2. A Cox proportional hazards regression model was used to discern the influence of multiple clinical variables on late survival. Regression coefficients and odds ratios with 95% confidence intervals were calculated to determine the relative influence of each covariate on the survivor function. Coefficients were computed by the method of maximum likelihood. For a listing of covariates used to predict late mortality, see online Appendix E3. A stepwise multivariate linear regression model was constructed to determine independent predictors of physical and mental health summary scores on the SF-36. For a listing of covariates used to predict physical and mental summary scores, see online Appendix E4).

Patient survival was expressed by actuarial analysis according to the method of Kaplan and Meier, with time zero as the date of operation and late death as the end point (with variability expressed as SEM). Patients alive at the last follow-up were included as right-censored values in the analysis. The equality of survival distribution was tested with the log-rank algorithm. Data collected were analyzed with the biostatistical capabilities of the Number Cruncher Statistical Systems (Kaysville, Utah).

RESULTS

Hospital complications included reoperation for bleeding in 34 patients (3.2%), perioperative myocardial infarction in 16 patients (1.5%), low cardiac output in 172 patients (16.2%), cardiac arrest in 83 patients (7.8%), renal insufficiency in 105 patients (9.8%), respiratory insufficiency in 189 patients (17.8%), cerebrovascular accident in 34 patients (3.2%), and deep sternal infection in 16 patients (1.5%). The overall incidence of postoperative morbidity for the group was acceptable, with most patients (67.0%, n = 712) having no hospital complications. The average postoperative stay for patients was 12.1 ± 9.3 days.

The overall in-hospital mortality for the series was 9.7% (97/1062), but it declined during the course of the study, decreasing to 2.2% in the most recent years (Figure 1). Mortalities were 8.8% (57 of 651) for men and 9.7% (40/411) for women ($P = .59$). The elective procedure mortality was 8.3% (64/768), the urgent procedure mortality was 11.0% (16/146), and the emergency and salvage mortality was 33.3% (17/51). A within-group comparison of mortalities for elective versus nonelective procedures revealed a significant difference ($P = .002$). Mortalities were 10.2% (88/948) for first operation and 8.6% (9/105) for reoperation.

To identify independent correlates of hospital mortality, preoperative and intraoperative variables were entered into a forward stepwise logistic regression model. Date of surgery ($P = .006$), arrhythmia ($P = .004$), abnormal ejection fraction ($P = .010$), renal insufficiency ($P = .001$), nonelective surgery ($P = .015$), conduit type (no ITA, $P = .030$), and perfusion time (cardiopulmonary bypass time, $P = .011$) were correlated with in-hospital mortality (Appendix Table E1).

QOL and initial clinical follow-up data were collected for 950 patients discharged from the hospital (98.4%). The initial follow-up ranged from 1.0 months to 12.6 years (mean, 3.4 years). The cumulative follow-up for the series was 3251.2 patient-years.

On completion of the QOL follow-up, many current survivors had clinical and functional improvement and were