

# Arterial coronary artery bypass grafting is safe and effective in elderly patients

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## ABSTRACT

**Objectives:** Bilateral internal thoracic artery grafting in elderly patients is controversial. We compared the outcome of bilateral internal thoracic artery grafting with that of single internal thoracic artery and saphenous vein and radial artery conduits in these patients.

**Methods:** Patients aged 70 years or more who underwent bilateral internal thoracic artery grafting between 1996 and 2008 (n = 1045) were compared with patients who underwent coronary artery bypass grafting with a single internal thoracic artery + saphenous vein graft (n = 582) or a single internal thoracic artery + radial artery (n = 249).

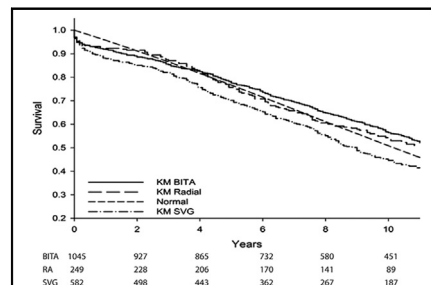
**Results:** Prevalence of female gender, diabetes, emergency operation, and chronic obstructive pulmonary disease was lower in the bilateral internal thoracic artery grafting group compared with the internal thoracic artery + radial artery and internal thoracic artery + saphenous vein graft groups, whereas congestive heart failure and recent myocardial infarction were more prevalent in the bilateral internal thoracic artery grafting group. Operative mortality and sternal wound infections were not significantly different between groups. The mean follow-up was 8.17 ± 4.45 years. Ten-year survival (Kaplan–Meier) in the internal thoracic artery + saphenous vein graft group was significantly lower than in the bilateral internal thoracic artery grafting and internal thoracic artery + radial artery groups ( $P < .001$ ). Assignment to the saphenous vein graft group was also associated with decreased adjusted survival ( $P < .001$ ) compared with the bilateral internal thoracic artery and internal thoracic artery + radial artery groups.

**Conclusions:** This study supports the use of arterial grafts in elderly patients undergoing coronary artery bypass grafting. (J Thorac Cardiovasc Surg 2015;150:607-12)

Bilateral internal thoracic artery (BITA) grafting is associated with improved survival compared with a single internal thoracic artery (ITA) and saphenous vein graft (SVG).<sup>1</sup> In addition to improved survival, patients who underwent BITA reportedly had better event-free survival and reduced occurrence of reinterventions.<sup>1</sup> Despite the improved long-

term outcome, surgeons are reluctant to use BITA grafting in the elderly because of the excellent survival benefit obtained with single ITA<sup>2,3</sup> and the increased risk of sternal dehiscence and sternal infection<sup>4-6</sup> caused by the more extensive devascularization associated with harvesting 2 ITAs.<sup>7,8</sup>

Extensive arterial grafting with BITAs has been used preferentially in a selected group of young male, nonobese, nondiabetic patients in several studies.<sup>9-11</sup> Patients were preselected for BITA grafting according to their life expectancy, and only a few patients aged more than 70 years were offered the option of BITA grafting. Unlike in those trials, we did not preselect patients for BITA grafting according to their life expectancy and performed complete arterial grafting with BITAs as the preferred method of myocardial revascularization for all age groups throughout the study period.<sup>12</sup> We used BITA grafting in



Survival of patients undergoing arterial grafting compared with a single ITA + SVG.

## Central Message

Patients aged 70 years or more who underwent BITA or SITA + RA grafting have better long-term survival than patients who underwent ITA + SVG.

## Perspective

The findings of our study support the use of BITA and RA in patients aged more than 70 years. They show similar rates of sternal wound complications and improved long-term survival of patients who underwent CABG with arterial grafts compared with a single ITA and SVG.

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**Abbreviations and Acronyms**

BITA	= bilateral internal thoracic artery
CABG	= coronary artery bypass grafting
CI	= confidence interval
COPD	= chronic obstructive pulmonary disease
euroSCORE	= European System for Cardiac Operative Risk Evaluation
HR	= hazard ratio
ITA	= internal thoracic artery
OBCAB	= off-pump coronary artery bypass
RA	= radial artery
RCA	= right coronary artery
RITA	= right internal thoracic artery
SVG	= saphenous vein graft

61% of the patients who were referred for coronary artery bypass grafting (CABG), and 41% of the entire cohort was aged 70 years or more. The goal of our current study was to compare the outcome of BITA grafting with that of single ITA and other conduits, such as SVG or radial artery (RA) grafting, in patients aged 70 years or more.

**PATIENTS AND METHODS**

This retrospective review of medical records and the use of a telephone questionnaire for obtaining follow-up information were approved by the institutional review board of the Tel Aviv Medical Center. Informed consent was waived. Between 1996 and 2008, 1045 patients aged 70 years or more with multivessel coronary artery disease underwent left-sided (left anterior descending artery and circumflex system) BITA grafting. They were compared with 582 patients who underwent CABG with single ITAs and SVGs and 249 patients who underwent CABG with a single ITA and RA in our institution. The study comprises all patients in this age group who underwent multivessel bypass surgery during the years of the study. Follow-up, which was 98% complete, was obtained by means of the Israeli National Registry database and a telephone questionnaire that elicited non-validated survival information.

**Surgical Techniques**

Operations were performed using standard cardiopulmonary bypass (CPB) or off-pump coronary artery bypass (OPCAB). Myocardial preservation during CPB involved intermittent antegrade or retrograde blood cardioplegia (30°C–32°C). Coronary stabilization during OPCAB was facilitated using CardioThoracic Systems stabilizers (CardioThoracic Systems Inc, Cupertino, Calif) or the Octopus system (Medtronic, Minneapolis, Minn). ITAs were mobilized from the chest wall as skeletonized vessels. In most cases, BITA was used to graft the left coronary system, that is, the myocardial territory supplied by the left anterior descending and circumflex arteries. Two arrangements were implemented: a free right ITA (RITA) attached proximally end-to-side on the left ITA in a T-graft configuration (composite T-graft) and an in situ BITA with an ante-aortic crossover RITA. All RAs were attached end-to-side to the LITA as a composite T-graft. The choice of configuration was determined by previously detailed technical considerations.<sup>12–14</sup> During the study period, the choice of BITA and not single ITA and SVG or single ITA and RA was made mainly according to the surgeon's preference. Arterial revascularization is the preferred method in our department in all age

groups, including the elderly. There is no significant variation in this approach among all surgeons within our group. There was a tendency not to choose BITA in emergency and critical patients and in patients with an increased risk for sternal wound complications (eg, patients with chronic obstructive pulmonary disease [COPD] or female patients with diabetes or obesity).<sup>15,16</sup> In addition, a composite T-graft with the RA was used only when target coronary vessel stenosis was greater than 80% to 90%.<sup>14,17</sup> The type of conduit selected for right coronary artery (RCA) grafting was not related to the configuration of the ITAs. Our strategy was to use RITAs, right gastroepiploic arteries, and RAs as grafts to the RCA branches only in the presence of a significant stenosis (ie, >80%).<sup>17</sup> When the RCA system was unsuitable for arterial grafting, such as in cases with a potential for high competitive flow in the RCA, we selected SVGs as the conduit for revascularization of the RCA. To decrease the risk of spasm of the arterial grafts, all patients were treated with a high-dose intravenous infusion of isosorbide dinitrate (Isoket [UCB, Brussels, Belgium], 4–20 mg/h) during the first 48 postoperative hours. Calcium-channel blockers (diltiazem, 90–180 mg/d, orally) were given starting from the second postoperative day and continued for at least 3 subsequent months to patients whose surgery included a right gastroepiploic artery or a RA.<sup>13</sup>

**Definition of Terms and Data Collection**

Patients' data were analyzed according to American College of Cardiology/American Heart Association Clinical Data Standards.<sup>18</sup> Chronic renal failure was diagnosed if the creatinine level exceeded 1.8 mg/dL. Peripheral vascular disease included all symptomatic and asymptomatic extracoronary arteriopathy. Cerebrovascular disease included a history of any cerebrovascular event with or without permanent neurologic damage. Our definition of "emergency operation" is based on the Society of Thoracic Surgeons guidelines and includes patients undergoing operation within 24 hours of cardiac catheterization; those with ongoing angina, acute evolving myocardial infarction, or pulmonary edema; or those in cardiogenic shock.<sup>19</sup> Patients who required emergency surgery and were not stabilized after intra-aortic balloon counterpulsation usually underwent operation using 1 ITA combined with SVGs. A perioperative myocardial infarction was defined by the appearance of new Q waves on the electrocardiogram associated with elevated levels of creatine phosphokinase-MB fraction greater than 50 mU/mL. A cerebrovascular accident was defined as a new permanent neurologic deficit and computed tomography evidence of cerebral infarction. Deep sternal infection in this setting was defined as the presence of deep infection in combination with late dehiscence requiring sternectomy.

**Statistical Analysis**

Data are expressed as the mean  $\pm$  standard deviation or as a proportion. The chi-square test and 2-sample *t* tests were used to compare discrete and continuous variables, respectively. Expected operative mortality was calculated using the logistic European System for Cardiac Operative Risk Evaluation (euroSCORE)<sup>20</sup> and compared with the observed operative (30-day) mortality. Multivariable logistic regression analysis was used to predict early mortality and early morbidity events by various risk factors. The odds ratios (ORs) and 95% confidence intervals (CIs) were compiled. The postoperative survival of each group was expressed by the Kaplan–Meier method, and survival curves were compared by the log-rank test.

The median follow-up for the BITA, RA, and SVG groups were 8.8, 9.1, and 7.4 years, respectively. Twenty-five percent of the BITA, RA, and SVG groups were followed for more than 12.5, 10.8, and 10.6 years, respectively, and 10% were followed for more than 14.8, 11.7, and 12.5 years, respectively.

The Cox proportional hazard model was used to evaluate the influence of preoperative variables and operative data on late and overall mortality. The Cox model was used to compare adjusted survival between the various conduit groups after controlling for differences between groups in

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