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Routine use of bilateral internal thoracic artery grafting in women: A risk factor analysis for poor outcomes☆,☆☆

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ABSTRACT

Background: Concerns about increased risk of postoperative complications, primarily deep sternal wound infection (DSWI), prevent liberal use of bilateral internal thoracic artery (BITA) grafting in women. Consequently, outcomes after routine BITA grafting remain largely unexplored in female gender.

Methods: Of 786 consecutive women with multivessel coronary disease who underwent isolated coronary bypass surgery at the authors' institution from 1999 throughout 2014, 477 (60.7%; mean age: 70 ± 7.7 years) had skeletonized BITA grafts; their risk profiles, operative data, hospital mortality and postoperative complications were reviewed retrospectively. Risk factor analysis for hospital death, DSWI and poor late outcomes were performed by means of multivariable models.

Results: There were 19 (4%) hospital deaths (mean EuroSCORE II: 5.2 ± 6.1%); glomerular filtration rate < 50 ml/min was an independent risk factor ($p = 0.035$). Prolonged invasive ventilation (11.3%), multiple blood transfusion (12.1%) and DSWI (10.7%) were most frequent major postoperative complications. Predictors of DSWI were body mass index >35 kg/m^2 ($p = 0.0094$), diabetes ($p = 0.005$), non-elective surgical priority ($p = 0.0087$) and multiple blood transfusions ($p = 0.016$). The mean follow-up was 6.8 ± 4.5 years. The non-parametric estimates of the 13-year freedom from cardiac and cerebrovascular deaths, major adverse cardiac and cerebrovascular events, and repeat myocardial revascularization were 76.1 [95% confidence interval (CI): 73.1–79.1], 59.5 (95% CI: 55.9–63.1) and 91.9% (95% CI: 90.1–93.7), respectively. Preoperative congestive heart failure ($p = 0.04$) and left main coronary artery disease ($p = 0.0095$) were predictors of major adverse cardiac and cerebrovascular events.

Conclusions: BITA grafting could be performed routinely even in women. The increased rates of early postoperative complications do not prevent excellent late outcomes.

1. Introduction

In coronary artery bypass graft (CABG) surgery as well as in every cardiac operation, female gender is a predictor of poor early and late outcomes. In almost all scoring systems specifically designed to predict the operative risk after cardiac surgery, female gender is among the risk factors for hospital, or 30-day mortality [1–4]. In almost all studies reporting immediate postoperative complications and long-term outcomes after CABG surgery, the results are worst in women [5,6].

In the last decade, the use of bilateral internal thoracic artery (BITA) grafting for myocardial revascularization has proven to be useful to improve long-term survival [7–9], even for high-risk patients such as dialysis [10] or insulin-dependent patients [11]. However, the use of BITA grafting is limited, and sometimes discouraged in women because of concerns about increased risk of postoperative complications, primarily deep sternal wound infection (DSWI) [12–14]. Consequently, outcomes of routine BITA grafting remain largely unexplored in female gender. This disparity in BITA use by sex should be addressed in the interest of expanding the benefits of BITA grafting to more large number of patients.

The present authors have reviewed retrospectively their 16-year experience in routine use of BITA grafting in women. The aims of the study were to report immediate and long-term results and perform a risk factor analysis for poor outcomes.

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2. Patients and methods

From January 1999 to December 2014, 786 consecutive women with multivessel coronary artery disease had isolated CABG surgery with at least one internal thoracic artery (ITA) graft at the authors' institution; in 477 (60.7%) cases, BITA grafts were used for myocardial revascularization of the antero-septal and postero-lateral cardiac walls (left-sided revascularization). The baseline characteristics and risk profiles of these BITA patients are listed in Table 1. The expected operative risk for each patient was calculated according to the European System for Cardiac Operative Risk Evaluation II (EuroSCORE II) [1].

The protocols of preoperative evaluation of the suitability of both ITAs to be used as coronary grafts, of preoperative antibiotic management and of perioperative control of hyperglycemia that were adopted at the authors' institution have been described in previous authors' reports [11,13,15]. The definitions of preoperative clinical variables and postoperative complications were the same as have been previously used by the authors [11,13,15]. All perioperative data were prospectively recorded for every patient in a computerized data registry.

Approval to conduct the study was acquired from the Hospital Ethics Committee based on retrospective data retrieval; the need for patients to provide their individual written consent was waived.

Table 1
Preoperative patients' characteristics and risk profiles[a].

Characteristic	n = 477
Age, years	70 ± 7.8 (66–76)
<60	53 (11.1)
60–69	136 (28.5)
70–79	254 (53.2)
>80	34 (7.1)
Hypertension	373 (78.2)
Former smoker	52 (10.9)
Current smoker	10 (2.1)
BMI, kg/m^2	26.7 ± 4.3 (23.6–29.3)
>30	91 (19.1)
>35	20 (4.2)
Diabetes on insulin	49 (10.3)
Diabetes on hypoglycemic agent	96 (20.1)
Serum glucose >200 mg/dl	29 (6.1)
Serum hemoglobin, g/l	12.2 ± 1.3 (11.3–13)
<12	207 (43.4)
Poor mobility[b]	6 (1.3)
Chronic lung disease[b]	23 (4.8)
GFR[c], ml/min	60.2 ± 24.5 (47.7–73)
50–85[b]	271 (56.8)
<50[b]	137 (28.7)
Chronic dialysis	10 (2.1)
Extracardiac arteriopathy[b]	123 (25.8)
Atrial fibrillation	10 (2.1)
Congestive heart failure	44 (9.2)
Unstable angina	245 (51.4)
Recent myocardial infarction[b]	117 (24.5)
Coronary artery disease	
Left main	159 (33.3)
Two-vessel	56 (11.7)
Three-vessel	344 (72.1)
LVEF, %	56.8 ± 10 (52–60)
30–50[b]	100 (21)
20–30[b]	3 (0.6)
<20[b]	3 (0.6)
Previous PCI	11 (2.3)
Previous CABG surgery (SVGs alone)	2 (0.4)
Critical state[b]	39 (8.2)
Use of IABP	13 (2.7)
Surgical priority[b]	
Elective	150 (31.4)
Urgent	322 (67.5)
Emergency	5 (1)
Expected operative risk (by EuroSCORE II[d]), %	5.2 ± 6.1 (1.9–6.2)

BMI = body mass index; CABG = coronary artery bypass grafts; EuroSCORE = European System for Cardiac Operative Risk Evaluation; GFR = glomerular filtration rate; IABP = intra-aortic balloon pumping; LVEF = left ventricular ejection fraction; PCI = percutaneous coronary intervention; SD = standard deviation.

[a] Values are number of patients with percentage in brackets, or mean ± SD with interquartile range in brackets.

[b] Definitions were those employed for EuroSCORE II [1].

[c] The creatinine clearance rate, calculated according to the Cockcroft–Gault formula, was used for approximating the GFR.

[d] [1].

2.1. Surgery

The surgical techniques that were used have been previously described [11,13,15]. In brief, surgery was carried out via a median sternotomy with cardiopulmonary bypass and cross-clamping the aorta. Myocardial protection was achieved with multidose cold blood cardioplegia delivered in both antegrade and retrograde mode. Off-pump technique was adopted only in the presence of a diffusely atherosclerotic ascending aorta (confirmed by epiaortic ultrasonography scan). Both ITAs were harvested as skeletonized conduits with low-intensity bipolar coagulation forceps, and used as in-situ grafts when possible. The right ITA was preferentially directed to the left anterior descending coronary artery and the left ITA to the postero-lateral cardiac wall. Additional coronary bypasses were performed with saphenous vein grafts. Sometimes, the ITA was taken down and used as a free graft either from the in-situ contralateral ITA (Y-graft) or the proximal (aortic) end of a saphenous vein graft. The aortic anastomosis of every venous graft was performed during cross-clamping of the ascending aorta in on-pump technique, and during aortic side-clamping in off-pump technique (Table 2).

2.2. Follow-up

An up-to-date clinical follow-up was obtained by a telephonic interview with the patients or their family. The occurrence of at least one postoperative major adverse cardiac and cerebrovascular event (MACCE) – defined as any of the following complications from hospital discharge to follow-up: sudden death, recurrent angina, myocardial infarction, congestive heart failure, percutaneous coronary intervention, reoperation, pulmonary embolism and cerebrovascular accident – was recorded. For this study, follow-up was closed on December 1st, 2015.

2.3. Statistical methods

Values are number of patients with percentage in brackets, or mean ± standard deviation with interquartile range in brackets. Risk factors analysis both for hospital death and DSWI was performed. Clinical variables were compared using the Chi-square, the Fisher's exact or

Table 2
Operative data[a].

Data	n = 477
No. of coronary anastomoses	3.5 ± 0.9 (3–4)
With BITA graft	2.6 ± 0.7 (2–3)
With SVGs	0.9 ± 0.8 (0–1)
Use of BITA graft alone	138 (28.9)
Surgical technique	
Off-pump	34 (7.1)
Beating heart on-pump	4 (0.8)
On-pump	439 (92)
CPB time, min	97 ± 36.4 (73–115)
Aortic cross-clamping time, min	74.3 ± 25.6 (56–90)
Duration of surgery, min	273.4 ± 65.6 (236–300)

BITA = bilateral internal thoracic artery; CPB = cardiopulmonary bypass; SD = standard deviation; SVG = saphenous vein graft.

[a] Values are number of patients with percentage in brackets, or mean ± SD with interquartile range in brackets.

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