

# The Impact of Diabetes on Early Outcomes after Routine Bilateral Internal Thoracic Artery Grafting



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## Background

Increased risk of postoperative complications limits use of bilateral internal thoracic artery (BITA) grafting in diabetic patients. The authors' experience in routine BITA grafting was reviewed to investigate the impact of diabetes on early outcomes.

## Methods

Among the 4508 consecutive patients with multivessel coronary artery disease who underwent isolated coronary bypass surgery from January 1999 throughout August 2015, skeletonised BITA grafts were used in 3228 (71.6%) patients, 972 diabetic and 2256 non-diabetic. After one-to-one propensity score (PS)-matched analysis, 819 pairs of diabetic/non-diabetic patients were compared for postoperative outcomes. The operative risk was calculated for each patient according to the European System for Cardiac Operative Risk Evaluation II (EuroSCORE II).

## Results

Although diabetic had higher risk profiles than non-diabetic patients both in unmatched (EuroSCORE II: 5.3 ±7.3% vs. 3±4.2%,  $p<0.0001$ ) and PS-matched series (EuroSCORE II: 5.1±7.1% vs. 3.6±4.3%,  $p<0.0001$ ), there were no differences in hospital mortality (2.2% vs. 1.8%,  $p=0.52$  and 2.1% vs. 2.3%,  $p=0.74$ , respectively). In PS-matched pairs, the use of adrenergic agonists ( $p=0.03$ ), postoperative bleeding ( $p=0.0055$ ) and deep incisional sternal wound infection ( $p=0.0018$ ) were more frequent in diabetic patients who had a mean of longer hospital stays ( $p=0.023$ ).

## Conclusions

Bilateral internal thoracic artery grafting may be routinely performed even in diabetic patients despite higher risk profiles. Increased postoperative complications prolong hospital stay but do not impact on early mortality.

## Keywords

Coronary artery bypass grafts • Arterial grafts • Diabetes mellitus • Outcomes • Surgery  
• Complications

## Introduction

Diabetic patients usually suffer from high rates of comorbidities such as cerebrovascular disease, coronary artery

disease, congestive heart failure, renal impairment, end-stage renal failure and peripheral vascular disease, and all-cause mortality. Early and late outcomes of cardiac and vascular operations for these high-risk patients

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are generally worse than for their non-diabetic counterparts [1].

In diabetic patients with multivessel coronary artery disease, the use of bilateral internal thoracic artery (BITA) grafting for myocardial revascularisation appears to improve the long-term outcomes of surgery because of superior graft patency [2–5]. Bilateral internal thoracic artery grafting in diabetic patients, however, remains a controversial issue mainly due to the increased risk of major postoperative complications [6–9].

The aim of the present study was to review retrospectively the authors' experience in routine BITA grafting. Diabetic and non-diabetic patients were compared according to preoperative clinical characteristics and risk profiles, operative data, early mortality, postoperative complications and length of hospital stay in order to investigate the impact of diabetes on early postoperative outcomes.

## Patients and Methods

From January 1999 throughout August 2015, 4508 consecutive patients with multivessel coronary artery disease underwent isolated coronary artery bypass grafts (CABG) surgery at the authors' institution. Bilateral internal thoracic artery grafting was used for left-sided myocardial revascularisation in 3228 (71.6%) cases. Of these BITA patients, 972 (30.1%) were diabetic and 2256 (69.9%) non-diabetic.

To evaluate the suitability of both internal thoracic arteries (ITAs) to be used as coronary grafts, all patients had undergone bilateral selective angiography of the subclavian artery during preoperative coronary angiography. All diabetic patients were treated during operation, and then in intensive care unit with a continuous intravenous insulin infusion [10].

## Definitions

Unless otherwise stated, definitions of preoperative clinical variables were those employed for the European System for Cardiac Operative Risk Evaluation II (EuroSCORE II) [11]. Poor preoperative glycaemic control was defined as basal serum glucose >200 mg/dl at three consecutive measurements before surgery. Diffuse atherosclerotic ascending aorta was demonstrated by epiaortic ultrasonography scan, which was performed intraoperatively in every patient [12]. The risk profile for each patient was calculated according to EuroSCORE II [11].

Early mortality included both deaths within 30 days after surgery (30-day mortality) and deaths in any time before hospital discharge (hospital mortality). Early mortality was primary end-point. Postoperative neurological dysfunction included delayed awakening, manifest psychiatric disorder, seizures, stroke and critical illness polyneuropathy. Low cardiac output was defined as three consecutive cardiac index measurements <2.0 l/min/m<sup>2</sup> despite adequate preload, afterload and inotropic support, or intra-aortic balloon pumping (IABP). Postoperative myocardial infarction was defined according to the definition criteria for type V myocardial infarction by Moussa et al. [13]. Acute kidney injury

was defined according to the Kidney Disease: Improving Global Outcomes (KDIGO) criteria [14]. Acute gastrointestinal dysfunction included acute gastrointestinal bleeding, acute cholecystitis and intestinal necrosis. The Centres for Disease Control and Prevention classification of the surgical site infections was adopted to define sternal wound infections [15]. For the purposes of this study, deep incisional infection and mediastinitis were considered deep sternal wound infections (DSWI). Finally, diaphragmatic dysfunction (probably due to phrenic nerve injury) needing prolonged invasive ventilation was confirmed by sonography. Postoperative complications were secondary end-points.

## Surgery

Surgery was carried out via a median sternotomy either with cardiopulmonary bypass, with or without cross-clamping the aorta or off-pump technique. When a period of myocardial ischaemia was used, myocardial protection was usually achieved with multidose cold blood cardioplegia delivered both in an antegrade and retrograde mode. A single-dose crystalloid solution (Custodiol-HTK® solution; Essential Pharma, Newtown, Pennsylvania, USA) was sometimes preferred, especially when longer ischaemic times were expected [16]. Off-pump and beating heart on-pump techniques were adopted only in the presence of a diffusely calcified ascending aorta.

Both ITAs were harvested as skeletonised conduits with low-intensity bipolar coagulation forceps, extending from the inferior border of the subclavian vein distally to the bifurcation into the superior epigastric and musculophrenic arteries [17]. Both ITAs were used as in situ grafts when possible. Right ITA was preferentially directed to the left anterior descending coronary artery and the left ITA to the posterolateral cardiac wall. The ante-aortic crossover right ITA bypass graft was protected by means of a pedicled flap taken from the thymic remnants [18]. Additional coronary bypasses, usually for the right coronary artery, were performed with radial artery (rarely) or saphenous vein grafts. Sometimes, 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 [9].

Standard single-loop sternal wiring technique was preferentially used as sternal closure system until 2009. Since 2010, the Erdinc double-loop sternal wiring technique has been adopted systematically [19].

All perioperative data were prospectively recorded for every patient in a computerised data registry (FileMaker Pro 12.0; FileMaker Inc., Santa Clara, California, USA). Approval to conduct the study was acquired from the Hospital Ethics Committee, based on retrospective data retrieval, having waived the need for patients to provide their written individual consent.

## Statistical Methods

Data were expressed as number of patients, mean ± standard deviation, or median, with the percentage or the range between the first and the third quartile (interquartile range)

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