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ORIGINAL ARTICLE

Off-pump Bilateral Internal Thoracic Artery Grafting☆

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Background The long-term benefit of bilateral internal thoracic grafts (BITA) is well established. BITA grafting is often avoided in diabetic, female, obese, elderly and other high-risk patients because of concerns for deep sternal wound infection. The objective of this study is to analyse early results of our BITA grafting and to establish the safety of BITA use in all patients.

Methods All cases of isolated consecutive unselected CABG were included in this retrospective study. BITA were used in-situ – one was used to graft left anterior descending artery and the other was used as inflow for a composite graft with radial artery. Dual inflow using in situ BITA grafting allows easy bailout by using an additional vein graft.

Results BITA was used in 574 patients out of 602 (95.35%). Incidence of early death was 1.33% (8/602), stroke 0.5% (3/602), reoperation for bleeding 0.17% (1/602). Deep sternal wound infection was not seen in any patient but nine patients (1.5%) had superficial wound infection which healed with dressing.

Conclusion We have used BITA in 95% of our unselected, consecutive off-pump CABG patients without any major wound complications. Our limited experience has shown off-pump CABG using BITA grafting can be safely adopted routinely with excellent early result.

Keywords Coronary artery bypass graft CABG • CABG arterial graft • Off-pump surgery • CABG new technology • Anaortic off-pump CABG • Bilateral internal thoracic artery grafting

Introduction

Long-term benefit of bilateral internal thoracic grafts (BITA) is well-established [1–5]. Still there is reluctance amongst surgeons to adopt routine BITA grafting. It is often agreed that there is no real contraindication to BITA grafting [6]. BITA grafting is often avoided in female patients and in patients with diabetes, obesity, old age, diffuse disease, renal impairment and poor left ventricular function. We have been using BITA grafting routinely in all patients even with all of the above mentioned risk factors. The objective of this study is to analyse our early results of off-pump BITA grafting and establish the short-term safety of routine off-pump BITA grafting.

Patients and Methods

The study was conducted in accordance with the principles of the declaration of Helsinki. All cases of consecutive,

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unselected isolated coronary artery bypass grafting (CABG) operated by the first author from March 2007 to June 2014 were included in this retrospective study from the prospectively collected data and operation records. Preoperative, operative and postoperative records of all the patients were analysed.

Definition of Variables: Age, sex, height, weight, hypertension (HT), chronic obstructive pulmonary disease (COPD) and diabetes mellitus (DM) data were collected from operation notes. Diffuse disease was noted from operation records and syntax scoring of angiogram was not performed. Patients with serum creatinine above normal value was taken as renal dysfunction, which was noted as ''yes'' if serum creatinine is above normal limit.

Surgical Technique: Off-pump coronary artery bypass grafting (OPCAB) was performed in all patients as a routine and through a median sternotomy. We used a maximum number of arterial grafts and both internal thoracic arteries (ITA) whenever possible. ITAs were harvested extrapleurally using a skeletonised technique. Vein graft was used when arterial grafts were not suitable for use or to supplement the length of arterial grafts. Aortic clamping was avoided whenever possible. ITAs were used in situ – one ITA was used to graft left anterior descending (LAD) artery and the other ITA was used as a composite graft with radial artery or saphenous vein (if radial artery was not available). After harvesting of grafts, LAD was grafted before any cardiac manipulation. In-situ left ITA (LITA) was used most frequently and sometimes right ITA (RITA) was also used to graft LAD artery.

OPCAB Technique: We did not use any deep pericardial stay suture. Warm saline soaked gauze pieces were used to position the heart. A suction type of stabiliser and mister blower were used for OPCAB grafting. Intracoronary shunts were used routinely. We did not use an apical stabilising device. Haemodynamic compromise during OPCAB was treated with inotropes and insertion of intra-aortic balloon pump [7]. The various configurations used were:

Configuration 1: LITA was used to graft LAD. After LITA-LAD anastomosis, RITA-RA ''y'' graft was constructed. RITA was used to graft a high diagonal or ramus intermedius or proximal obtuse marginal (end to side). After this RA was used to graft the lateral and inferior surface arteries.
Configuration 2: This was a similar to configuration 1 but sequential LITA was used to graft LAD in two places or diagonal LAD sequentially.
Configuration 3: LITA was used for LAD or diagonal and LAD. RITA was extended using RA – both were anastomosed end to end (I graft) and the RA was used to revascularise the lateral and inferior wall.
Configuration 4: RITA was used to graft LAD. After this, LITA-RA composite graft (I or Y graft) was created and this was used for the remaining vessels.
Configuration 5: LITA and RITA were both used as in-situ graft and no composite grafts were created.
Configuration 6: LITA – RA ''y'' graft when LITA was used for LAD system and RA was used for inferior and lateral wall; this provided single inflow. In one patient with documented LITA disease in angiography, RITA-RA ''y'' was used.
Configuration 7: In some patients with diffuse coronary artery disease – ''y'' graft was performed in both LITA and RITA either using bilateral radial artery or one RA and SVG (Saphenous Veinous Graft).

After grafting of LAD artery, the heart was lifted and other vessels for grafting were assessed. The composite graft between the other ITA and radial artery was created [8]. The remaining grafts were performed. The saphenous vein was used as an alternative or to supplement the radial artery whenever required.

Statistical Methods: A logistic regression was performed to ascertain the effects of age, sex, diabetes mellitus (DM), glycosylated haemoglobin level (HbA1C), body mass index (BMI), hypertension (HT), left ventricular ejection fraction (EF), diffuse coronary artery disease, preoperative renal dysfunction, chronic obstructive pulmonary disease (COPD) and total number of coronary distal grafts (Total Graft). The outcomes that were assessed were early death, reoperation for bleeding, stroke and infection.

Results

Preoperative characteristics are summarised in Table 1. Figure 1 shows the distribution of HbA1c level in all patients. There were eight early deaths (1.33%). A logistic regression was performed to ascertain the effects of age, sex, EF, HbA1C, DM, BMI, HT, Diffuse Disease, COPD, Renal dysfunction and Total Graft with the likelihood that participants have an outcome of early mortality (Table 2). Of the 11 predictor variables only two were statistically significant: female sex and diffuse disease (as shown in Table 2). Females had 17.21 times higher odds of exhibiting mortality than males and diffuse disease had 24.56 times higher odds of exhibiting mortality.

There were three patients (0.5%) who had postoperative stroke. Two of them had aortic anastomosis of a vein graft and the third patient had bilateral carotid disease and developed embolic stroke on the fifth postoperative day after anaortic OPCAB. There was one patient who required reoperation for postoperative bleeding.

There was no incidence of deep sternal wound infection (DSWI) in any of the patients. However nine patients (1.5%) had a superficial wound infection which healed with a dressing. A logistic regression was performed to ascertain the effects of age, sex, EF, HbA1C, DM, BMI, HT, Diffuse Disease, COPD, Renal dysfunction and Total Graft on the likelihood that participants would have an outcome of superficial infection (Table 3). Of the 11 predictor variables only two were statistically significant: HbA1C and COPD (as shown in Table 3). Increasing HbA1C was associated with an increased likelihood of exhibiting superficial infection and COPD had 15.69 times higher odds to exhibit superficial infection.