

Coronary Artery Bypass Revascularization Using Bilateral Internal Thoracic Arteries in Diabetic Patients: A Systematic Review and Meta-Analysis

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This study examined the effect of coronary artery bypass graft surgery with bilateral internal thoracic artery grafting in diabetic patients. Coronary artery bypass graft surgery using skeletonized bilateral internal thoracic artery grafts was not associated with an increased risk of deep sternal wound infection or early death. Moreover, patients who underwent coronary artery bypass graft surgery using bilateral internal

thoracic artery grafting had lower remote mortality and cardiac mortality. We conclude that coronary artery bypass surgery using bilateral internal thoracic artery grafts is an excellent strategy, even for diabetic patients.

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Coronary artery bypass graft surgery (CABG) is the coronary revascularization strategy of choice for patients with multivessel coronary artery disease [1]. Nevertheless, diabetes mellitus remains a strong risk factor for mortality and morbidity after CABG [2–4]. In the acute postoperative phase, diabetes is associated with an increased risk of infection due to hyperglycemia, relative immunodeficiency, and microcirculatory insufficiency [5]. Over the long term after CABG, diabetes is associated with an increased risk of death, cardiac death, and other adverse events as a result of a propensity toward severe atherosclerosis due to prothrombotic and proinflammatory states [4]. Meanwhile, CABG with internal thoracic artery (ITA) grafts can produce excellent outcomes, and the use of a left internal thoracic artery (LITA) to left anterior descending coronary artery graft, in particular, is associated with excellent long-term survival and a reduction in cardiac events due to graft patency; as a result, this strategy is the gold standard for CABG [6]. Coronary artery bypass graft surgery with bilateral internal thoracic artery (BITA) grafts is also sometimes used and is associated with good outcomes in nondiabetic patients [7–9]. In contrast, CABG with BITA in diabetic patients has historically been associated with a higher risk of deep sternal wound infection (DSWI) [10–22] and is therefore avoided. However, several recent studies have suggested that CABG with BITA grafts after skeletonized ITA harvesting is not associated with an increased risk of wound infection among diabetic patients [12, 14, 15, 20]. Thus, the goal of this study was to reexamine the safety and efficacy of CABG

with BITA grafts after skeletonized ITA harvesting in diabetic patients.

Material and Methods

Search Strategy

Database searches were performed in the first week of February 2014. The following sources were searched for studies comparing single internal thoracic artery (SITA) and BITA grafts for diabetic patients: MEDLINE through PubMed (from 1995 to August 2013), EMBASE, and the Cochrane Library database (Cochrane Central Register of Controlled Trials). The following MeSH subject headings were used: “coronary artery bypass,” “diabetes,” “single internal thoracic artery,” “bilateral internal thoracic artery,” “double internal thoracic artery,” “single internal mammary artery,” “bilateral internal mammary artery,” and “double internal mammary artery.” The clinicaltrials.gov website was also searched for trials comparing SITA and BITA grafts for diabetic patients. The references cited within all available articles were also reviewed to identify candidate studies. All titles and abstracts were downloaded to Zotero version 2.1 (Center for History and New Media of George Mason University, Fairfax, VA).

Inclusion and Exclusion Criteria

Studies satisfying the following criteria were included in this systematic review: (1) studies comparing SITA and BITA grafts for diabetic patients; (2) studies evaluating

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The Appendix Figure 1 can be viewed in the online version of this article [<http://dx.doi.org/10.1016/j.athoracsur.2014.09.045>] on <http://www.annalsthoracicsurgery.org>.

Abbreviations and Acronyms

- BITA = bilateral internal thoracic artery
- CABG = coronary artery bypass graft surgery
- CI = confidence interval
- DSWI = deep sternal wound infection
- ITA = internal thoracic artery
- LITA = left internal thoracic artery
- RR = relative risk
- SITA = single internal thoracic artery

postoperative DSWI, early mortality, or remote outcomes; and (3) studies published in peer-reviewed journals with full available text in English. Studies in which it was not possible to extract data from the published results, as well as studies that did not report appropriate outcomes, were excluded.

Endpoints and Their Definitions

The endpoints of this study were as follows: (1) DSWI; (2) early death; (3) long-term mortality; and (4) long-term cardiac mortality. Deep sternal wound infection was defined as DSWI or mediastinitis. Early death consisted of in-hospital or 30-day mortality. Long-term mortality and cardiac mortality were defined as the cumulative incidence of all-cause and cardiac death.

Data Extraction

Two reviewers (K.K. and T.Y.) independently assessed studies for inclusion criteria. The following information was extracted from each study: first author, year of publication, study design, loss to follow-up, age, sex, number of participants in each group (SITA and BITA), proportion of ITA skeletonization, proportion of off-pump CABG, number of grafts or distal anastomoses, and European System for Cardiac Operation Risk Evaluation (EuroSCORE). Reviewers extracted the following outcomes: DSWI, early mortality, long-term all-cause mortality, and long-term cardiac mortality. Outcome data are presented as count data.

Statistical Analysis

The study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement [23]. The endpoints of each study were analyzed using risk ratio (RR) with 95% confidence interval (CI). We conducted these meta-analyses only for studies that reported outcomes as count data; studies that reported outcomes as risk estimates (eg, hazard ratio and RR) were excluded from these analyses. Summary estimates were calculated by DerSimonian-Laird weights for the random effects model. Forest plots were then created for graphic presentation of clinical outcomes. The I² statistic was calculated as a measure of the proportion of the overall variation attributable to between-study heterogeneity rather than chance. The I² values of 25%, 50%, and 75% correspond to low, intermediate, and high levels of heterogeneity, respectively. The Cochran χ^2 (Cochran Q) test

was used to assess the between-study heterogeneity in different groups. Publication bias was assessed by Horbold-Egger statistics, with a *p* value of less than 0.05 indicating significant publication bias among the studies. The meta-analysis was conducted using StatsDirect software version 2.7.2 (StatsDirect, Greater Manchester, UK).

Results

Selection and Description of Studies

A total of 104 relevant studies were captured in the initial search (Fig 1). After screening the abstracts of these studies, the full-length articles of 13 studies fulfilled the inclusion criteria (Table 1). All 13 studies evaluated DSWI, had sample sizes ranging from 81 to 2,445, and were retrospective studies [10–22]. Of these, nine studies evaluated early death [11, 14–18, 20–22], eight studies evaluated long-term mortality [11, 12, 14–16, 18, 20, 21], and five studies evaluated long-term cardiac mortality [11, 12, 14, 15, 20]. Propensity-score matched analysis was reported in four studies [15, 18, 20, 21]. Ten studies mentioned a pedicle or skeletonized ITA [10–12, 14–17, 19, 20, 22]. Ten studies indicated the number of grafts or distal anastomoses [11, 12, 14–20, 22]. Seven studies indicated patients’ risk scoring, including EuroSCORE, The Society of Thoracic Surgeon Predicted Risk of Postoperative Mortality (STS-PROM) score, or

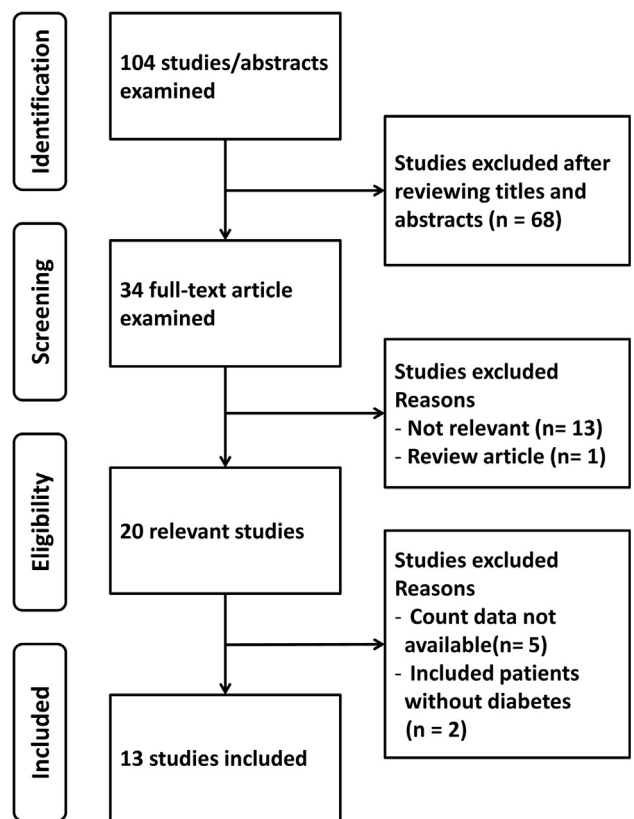


Fig 1. Flow diagram from the Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines demonstrates the method for selection of the included articles.

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