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Review

Skeletonized versus pedicled bilateral internal mammary artery grafting: Outcomes and concerns analyzed through a meta-analytical approach

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HIGHLIGHTS

- In the bilateral ITA scenario, the skeletonization has a protective effect against SWI.
- Diabetic patients benefit more from the skeletonization than the non-diabetic ones.
- The meta-regression identified no modulating factors influencing the results.

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ABSTRACT

Background: It is suggested that the internal thoracic artery (ITA) harvesting technique influences the incidence of sternal wound infection (SWI) after coronary artery bypass graft (CABG) surgery when both right and left ITAs are used. We conducted a meta-analysis to determine whether there is any difference between skeletonized versus pedicled bilateral ITA in terms of SWI after CABG. **Methods**: We performed a systematic-review using MEDLINE, EMBASE, CENTRAL/CCTR, SciELO, LILACS, Google Scholar and reference lists of relevant articles to search for studies that compared the incidence of SWI after CABG between skeletonized versus pedicled bilateral ITA until May 2014. The principal summary measures were odds ratio (OR) with 95% Confidence Interval (CI) and *P* values (statistically significant when <0.05). The ORs were combined across studies using weighted DerSimonian–Laird random effects model. Meta-analysis, sensitivity analysis and meta-regression were carried out by using the software Comprehensive Meta-Analysis version 2 (Biostat Inc., Englewood, New Jersey). **Results**: Eight studies involving 2633 patients (1698 skeletonized; 935 pedicled) met the eligibility criteria. There was no evidence for important heterogeneity of the effects among the studies. The overall OR (95% CI) of SWI showed statistical significant difference in favor to skeletonized ITA (random effect model: OR 0.327; 95% CI 0.217–0.492; $P < 0.001$). In sensitivity analysis, the difference in favor to skeletonized ITA was observed mainly in the presence of diabetes. In meta-regression, we observed no modulation of the effects. **Conclusion**: When both ITAs are used, the skeletonized technique appears to reduce the incidence of SWI after CABG in comparison to the pedicled technique.

1. Introduction

1.1. Rationale

Sternal wound infection (SWI) is a recognized and important complication of coronary artery bypass graft (CABG) surgery [1].

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The most serious manifestation of an SWI is mediastinitis, which extends the previous anatomical classification to the risk of sepsis. It is well known that an infection of the mediastinum can be severe and potentially lethal [2].

It is suggested that the method of internal thoracic artery (ITA) harvesting influences the incidence of postoperative SWI [3–5]. There are two established harvesting techniques: pedicled and skeletonized ITAs. Whereas the pedicled technique dissects the artery away from the sternum with its accompanying veins, fascia, adipose tissue, and lymphatics generating a pedicled graft, skeletonization requires the ITA to be dissected free of all surrounding tissue, solely yielding the artery [3].

Our meta-analysis attempts to determine if there is any real difference between skeletonized and pedicled bilateral ITA in terms of sternal wound infection.

1.2. Objectives

We performed a meta-analysis and meta-regression of studies to compare skeletonized versus pedicled bilateral ITA during CABG, according to the *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses (PRISMA) statement [6].

2. Methods

2.1. Eligibility criteria

Using PICOS (*P*opulation, *I*ntervention, *C*omparison, *O*utcome, *S*tudy design) strategy, studies were considered if: (1) population comprised patients undergoing CABG; (2) compared outcomes between skeletonized versus pedicled bilateral ITA; (3) outcomes studied included any situations considered as SWI – superficial, deep and/or mediastinitis; (4) were prospective or retrospective or non-randomized studies or randomized controlled trials.

2.2. Information sources

The following databases were used (until May 2014): MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials (CENTRAL/CCTR), ClinicalTrials.gov, SciELO (Scientific Electronic Library Online), LILACS (Literatura Latino-Americana e do Caribe em Ciências da Saúde – The Latin American and Caribbean Health Sciences), Google Scholar and reference lists of relevant articles.

2.3. Search

We conducted the search using Medical Subject Heading (MeSH) terms ('skeletonized' OR 'skeletonization') AND ('pedicled' OR 'pedunculated' OR 'in situ') AND ('arteries, mammary' OR 'artery, mammary' OR 'mammary artery' OR 'internal mammary artery' OR 'arteries, internal mammary' OR 'artery, internal mammary' OR 'internal mammary arteries' OR 'mammary arteries' OR 'mammary arteries, internal' OR 'mammary artery, internal' OR 'internal thoracic artery' OR 'arteries, internal thoracic' OR 'artery, internal thoracic' OR 'internal thoracic arteries' OR 'thoracic arteries, internal' OR 'thoracic artery, internal') AND ('coronary artery bypass graft' OR 'coronary artery bypass grafting' OR 'coronary artery bypass surgery' OR 'coronary bypass surgery' OR 'coronary artery bypass graft surgery' OR 'coronary artery bypass' OR 'coronary bypass').

2.4. Study selection

The following steps were done: (1) identification of titles of records through databases searching; (2) removal of duplicates; (3) screening and selection of abstracts; (4) assessment for eligibility through full-text articles; (5) final inclusion in study.

One reviewer followed the steps 1 to 3. Two independent reviewers followed step 4 and selected studies. Inclusion or exclusion of studies was decided unanimously. When there was disagreement, a third reviewer took the final decision.

2.5. Data items

The endpoints were Odds Ratio (OR) for SWI after CABG using skeletonized versus pedicled bilateral ITA.

2.6. Data collection process

Two independent reviewers extracted the data. When there was disagreement about data, a third reviewer (the first author) checked the data and took the final decision about it. From each study, we extracted patient characteristics, study design, and outcomes (number of events and number of total groups).

2.7. Risk of bias in individual studies

Included studies were assessed for the following characteristics: (1) sequence generation, (2) allocation concealment, (3) blinding, (4) incomplete outcome data, (5) selective outcome reporting, and (6) other sources of bias. Taking these characteristics into account, the papers were classified into A (low risk of bias), B (moderate risk of bias) or C (high risk of bias).

Two independent reviewers assessed risk of bias. Agreement between the 2 reviewers was assessed using kappa statistics for full text screening, and rating of relevance and risk of bias. When there was disagreement about risk of bias, a third reviewer (the first author) checked the data and took the final decision about it.

2.8. Summary measures

The principal summary measures were ORs with 95% Confidence Interval (CI) and *P* values (considered statistically significant when <0.05). The meta-analysis was completed using the software Comprehensive Meta-Analysis version 2 (Biostat Inc., Englewood, New Jersey).

2.9. Synthesis of results

Forest plots were generated for graphical presentations for clinical outcomes and we performed the I^2 test and Chi^2 test for the assessment of heterogeneity across the studies [7]. Inter-study heterogeneity was explored using the Chi^2-statistic, but the I^2 value was calculated to quantify the degree of heterogeneity across the studies that could not be attributable to chance alone. When I^2 was more than 50%, significant statistical heterogeneity was considered to be present. Each study was summarized by the difference in means of flow capacity for skeletonized ITA compared to pedicled ITA. The differences in means were combined across studies using weighted DerSimonian–Laird random effects model [8].

2.10. Risk of bias across studies

To assess publication bias, a funnel plot was generated, being statistically assessed by Begg and Mazumdar's test [9] and Egger's test [10].