Percutaneous coronary invervention versus coronary artery bypass grafting: A meta-analysis

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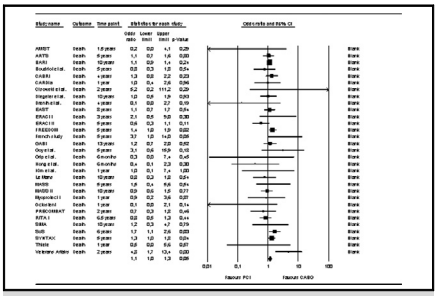
ABSTRACT

Objective: To compare the effectiveness of percutaneous coronary intervention (PCI) and coronary artery bypass grafting (CABG) in patients with coronary artery disease.

Methods: MEDLINE, Embase, and Cochrane Central were searched, and randomized controlled trials were included. Outcomes were assessed at maximum available follow-up.

Results: This meta-analysis includes 31 trials with 15,004 patients. As regards death, more patients died after PCI compared with CABG across all types of patients (odds ratio [OR], 1.1; 95% confidence interval [CI], 1.0-1.3; $P = .05$) as well as in patients with multivessel disease (OR, 1.2; 95% CI, 1.0-1.4; $P = .02$) or diabetes (OR, 1.6; 95% CI, 1.2-2.1; $P < .01$). Myocardial infarction occurred as frequently after PCI (OR, 1.2; 95% CI, 0.9-1.5; $P = .28$). Repeat revascularization was more common after PCI (OR, 4.5; 95% CI, 3.5-5.8; $P < .01$), with a progressive decline in ORs from the pre-stent era (OR, 7.0; 95% CI, 5.1-9.7; $P < .01$), to the bare metal stent era (OR, 4.5; 95% CI, 3.6-5.5; $P < .01$), and to the drug-eluting stent era (OR, 2.5; 95% CI, 1.8-3.4; $P < .01$). Stroke was more common after CABG (OR, 0.7; 95% CI, 0.5-0.9; $P = .01$).

Conclusions: Compared with PCI, CABG had a lower risk of death in multivessel disease or diabetes patients eligible for either intervention, a lower risk of repeat revascularization, but a higher risk of stroke. (J Thorac Cardiovasc Surg 2015;149:831-8)



Meta-analysed odds ratio for death after PCI or CABG at the latest available follow-up.

Central Message

We conducted a meta-analysis comparing the effectiveness of PCI to CABG in 31 trials on 15,004 patients. Compared to PCI, CABG had a lower risk of death in patients with multivessel disease or diabetes, and a lower risk of repeat revascularization and a higher risk of stroke in all patients.

Author Perspective

This paper supports current thoughts in myocardial revascularization directed to reconsider the role of surgical myocardial revascularization in patients with extensive coronary artery disease, particularly when affected by diabetes. On the other hand, this paper confirms that additional effort should be put in lowering the risk of perioperative neurologic complications in surgical myocardial revascularization because stroke is a rare but devastating and invalidating complication. Off-pump and aortic "no-touch" techniques may play a role in this perspective.

See Editorial Commentary pages 839-40.

Supplemental material is available online.

Revascularization for coronary artery disease can be performed with coronary artery bypass grafting (CABG) or percutaneous coronary intervention (PCI). For more than 20 years, trials have compared the effectiveness and safety of PCI versus CABG. The first trials compared balloon angioplasty to CABG. Improved technology has made it possible to treat increasingly complex lesions with PCI. At the same time, the outcome of CABG has improved because of better perioperative care and extended use of arterial revascularization. After the introduction of bare metal stents, several trials compared PCI with CABG in patients with multivessel disease. More recently, data from randomized trials of drug-eluting stents have shown significant reductions in the rate of repeat interventions with respect to bare metal stents. The latest trials therefore focused on PCI with drug-eluting stents versus CABG.

Earlier meta-analyses of randomized controlled trials (RCTs) comparing PCI versus CABG have been undertaken

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Abbreviations and Acronyms

AMIST = Angioplasty versus Minimally Invasive Surgery Trial
ARTS = Arterial Revascularization Therapies Study
AWESOME = Angina With Extremely Serious Operative Mortality Evaluation
BARI = Bypass Angioplasty Revascularization Investigation
CABG = coronary artery bypass grafting
CABRI = Coronary Angioplasty versus Bypass Revascularisation Investigation
CAD = coronary artery disease
CARDia = Coronary Artery Revascularization in Diabetes
CI = confidence interval
EAST = Emory Angioplasty versus Surgery Trial
EXCEL = Coronary Artery Bypass Surgery for Effectiveness of Left Main Revascularization
ERACI I = Argentine Randomized Trial of Percutaneous Transluminal Coronary Angioplasty Versus Coronary Artery Bypass Surgery in Multivessel Disease
ERACI II = Argentine Randomized Trial of Coronary Angioplasty With Stenting Versus Coronary Bypass Surgery in Patients with Multiple Vessel Disease trial
FREEDOM = Future REvascularization Evaluation in patients with Diabetes mellitus: Optimal management of Multivessel disease
GABI = German Angioplasty Bypass Surgery Investigation
LAD = left anterior descending coronary artery
LMCA = left main coronary artery
MASS = Medicine, Angioplasty, or Surgery Study
OR = odds ratio
PCI = percutaneous coronary intervention
PRECOMBAT = Premier of Randomized Comparison of Bypass Surgery versus Angioplasty Using Sirolimus-Eluting Stent in Patients with Left Main Coronary Artery Disease
RCT = randomized controlled trial
RITA = Randomised Intervention Treatment of Angina
SIMA = Stenting versus Internal Mammary Artery grafting trial
SYNTAX = Synergy Between Percutaneous Coronary Intervention With Taxus and Cardiac Surgery

with the purpose of evaluating both treatment modalities. These meta-analyses either are now outdated[E1-E3] or present only part of the picture, as they looked at particular disease categories,[E4-E10] specific types of surgery or PCI,[E1,E7,E11] or specific patients.[E12] Individual patient data meta-analyses have the advantage that time-to-event curves can be produced, and analyses of effects in clinically important subgroups can be estimated. However, they are limited by the willingness and/or ability of research groups to participate and share data.[E13-E15]

The present meta-analysis aims to compare the effectiveness and safety of PCI and CABG in patients for whom coronary revascularization is clinically indicated.

METHODS

Search Strategies

We used Cochrane systematic review methods to identify RCTs that met the inclusion criteria. MEDLINE, Embase, and Cochrane Central were searched on December 18, 2013, using text words and medical subheadings. Searches were limited to studies published from 1996 onwards, published in English, and undertaken in humans. Because of continuous improvement of techniques, devices, and medical treatment, studies published before 1996 were considered too old to have policy implications for current clinical practice. References of meta-analyses, reviews, and selected articles were scanned for additional RCTs. The websites www.controlled-trials.com and clinicaltrial.gov were searched for running and unpublished trials, and when such trials were found, the Internet was searched for preliminary or early results. Two databases (Database of Abstracts of Reviews of Effects and the Health Technology Assessment database) were searched via http://www.crd.york.ac.uk/crdweb/.

Inclusion Criteria

Studies were included if they concerned an RCT comparing PCI (with or without stenting) to CABG and if the trial participants were adults with stable or unstable angina, and had single-vessel or multivessel coronary disease.

Study Selection and Quality Criteria

Two reviewers (YS and HK or JV) independently selected the studies; discrepancies were resolved by consensus. Selected trials were assessed for their methodological quality (adequacy of randomization, adequacy of the allocation concealment, the potential for selection bias after allocation and the adequacy of masking) by 2 reviewers (YS and HK or JV) using a scheme based on Schulz et al, which was used in Cochrane reviews on CABG and PCI.[E1,E16,E17]

Data Extraction

Data were extracted by one reviewer (YS) and checked by a second (HK or JV). Events of interest included the primary outcome measures (all-cause death, myocardial infarction, repeat revascularization, and stroke), secondary outcome measures (cardiac death and angina-free survival), general characteristics of the included studies, and data on study participants (eg, type of