Effectiveness of Percutaneous Coronary Intervention Versus Coronary Artery Bypass Grafting in Patients With End-Stage Renal Disease

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The optimal coronary revascularization strategy (coronary artery bypass grafting [CABG] or percutaneous coronary intervention [PCI]) in patients with end-stage renal disease (ESRD) remains uncertain. We performed an updated systematic review and meta-analysis of observational studies comparing CABG and PCI in patients with ESRD using a random-effects model for the primary outcome of long-term all-cause mortality. Our review registered through PROSPERO included observational studies published after 2011 to ensure overlap with previous studies and identified 7 new studies for a total of 23. We found that the median sample size in the selected studies was 125 patients (25 to 15,784) with a large variation in the covariate risk adjustment and only 3 studies reporting the indications for the revascularization strategy. CABG was associated with a small reduction in mortality (relative risk 0.92, 95% CI 0.89 to 0.96) with significant heterogeneity demonstrated ($p = 0.005$, $I^2 = 48.6\%$). Subgroup analysis by categorized "year of study initiation" (<1990, 1991 to 2003, >2004) further confirmed the summary estimate trending toward survival benefit of CABG along with a substantial decrease in heterogeneity after 2004 ($p = 0.64$, $I^2 = 0\%$). In conclusion, our updated systematic review and meta-analysis demonstrated that in patients with ESRD referred for coronary revascularization, CABG was associated with a small decrease in the relative risk of long-term mortality compared with PCI. The generalizability of the finding to all patients with ESRD referred for coronary revascularization is limited because of a lack of known indications for coronary revascularization, substantial variation in covariate risk adjustment, and lack of randomized clinical trial data. **(Am J Cardiol 2016;117:1596−1603)**

The current evidence of the optimal coronary revascularization strategy (coronary artery bypass grafting [CABG] or percutaneous coronary intervention [PCI]) to improve long-term survival in patients with end-stage renal disease (ESRD) has been predominantly through the conduct of observational studies and not by randomized clinical trials. A recent meta-analysis of 17 observational studies in patients with ESRD noted that CABG was associated with an improved long-term survival (odds ratio 0.86, 95%CI 0.83 to 0.89) over PCI. However, significant heterogeneity was demonstrated ($p < 0.0001$, $I^2 = 83\%$).[1] Variation in study sample sizes has been suggested as a possible origin for the heterogeneity. Other possibilities are disparities in risk adjustment,[2,3] the use of analytic methods such as propensity score matching,[4] inclusion of angiographic variables,[5] and temporal changes[6] resulting in improvements of technique and equipment. The aim of the current report is to incorporate recently published studies on the comparative effectiveness between CABG and PCI on long-term mortality in patients with ESRD along with an improvement in our understanding of the origin of heterogeneity.

Materials

This review was conducted using a prespecified protocol. The protocol was registered at PROSPERO ("an international database of prospectively registered systematic reviews in health and social care", http://www.crd.york.ac.uk/PROSPERO/), PROSPERO number: CRD42015030148. Studies were eligible if they included at least 20 patients older than 18 years with ESRD. The primary intervention was CABG with PCI being the comparator. PCI included all devices and techniques used for percutaneous coronary artery revascularization including bare-metal and drug-eluting stents. CABG included the use of vein grafts and arterial grafts. The inclusion of updated studies was considered eligible if published from 2011 to March 2015. Studies were excluded if they included only patients with advanced chronic kidney disease (non-ESRD) or included patients

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See page 1602 for disclosure information.

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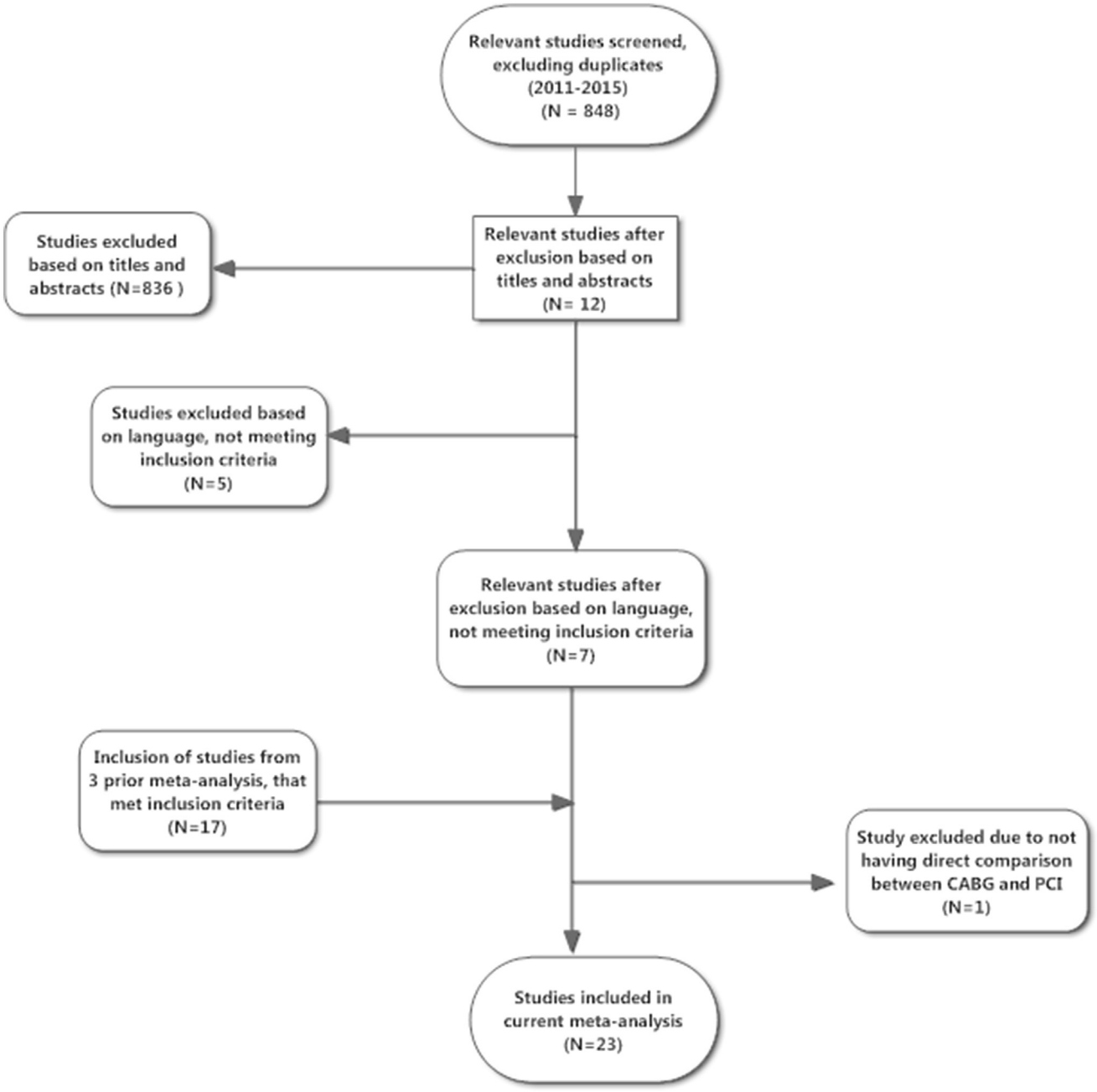

Figure 1. Flow diagram of study inclusion process.

who received another cardiac surgical procedure along with CABG (e.g., concomitant valve surgery). The primary outcome was all-cause mortality more than one year after coronary revascularization. We searched PubMED and EMBASE and the COCHRANE database for studies using the search query (['chronic kidney failure'/exp or 'albumin dialysis'/exp] and (['angioplasty'/exp or 'transluminal coronary angioplasty'/exp or 'coronary stent'/exp or 'coronary artery bypass graft'/exp] or 'coronary artery disease'/exp/dm_su) and [humans]/lim and [english]/lim) and (2011:py or 2012:py or 2013:py or 2014:py or 2015:py). The reference list of relevant studies and reviews was searched. A single reviewer independently screened each citation and those considered potentially applicable were retrieved for full text review. The number of events was estimated from Kaplan−Meier survival graphs when no other information was provided in the manuscript. This may overestimate the number of events but not influence the relative risk (RR).[7] The 2 primary reviewers independently abstracted data from the full texts. There was no attempt to contact primary investigators of relevant studies. No formal assessment of the quality of observational studies was performed.

Data were analyzed using STATA statistical software, version 13 (StataCorp LP, College Station, Texas). Study characteristics were described using percentages and qualitative descriptors. The RR of death $\geq$1 year for CABG