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ORIGINAL RESEARCH

The Identification of Calcified Coronary Plaque Is Associated With Initiation and Continuation of Pharmacological and Lifestyle Preventive Therapies

A Systematic Review and Meta-Analysis

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ABSTRACT

OBJECTIVES The aim of this study was to assess the odds of initiation or continuation of pharmacological and lifestyle preventive therapies in patients with nonzero versus zero coronary artery calcium (CAC) score detected on cardiac computed tomography.

BACKGROUND Detection of calcified coronary plaque could serve as a motivational tool for physicians and patients to intensify preventive therapies.

METHODS We searched PubMed, EMBASE (Excerpta Medica database), Web of Science, Cochrane CENTRAL (Cochrane central register of controlled trials), ClinicalTrials.gov, and the International Clinical Trials Registry Platform for studies evaluating the association of CAC scores with downstream pharmacological or lifestyle interventions for prevention of cardiovascular disease. Pooled odds ratios (ORs) of downstream interventions were obtained using the DerSimonian and Laird random effects model.

RESULTS After a review of 6,256 citations and 54 full-text papers, 6 studies (11,256 participants, mean follow-up time: 1.6 to 6.0 years) were included. Pooled estimates of the odds of aspirin initiation (OR: 2.6; 95% confidence interval [CI]: 1.8 to 3.8), lipid-lowering medication initiation (OR: 2.9; 95% CI: 1.9 to 4.4), blood pressure–lowering medication initiation (OR: 1.9; 95% CI: 1.6 to 2.3), lipid-lowering medication continuation (OR: 2.3; 95% CI: 1.6 to 3.3), increase in exercise (OR: 1.8; 95% CI: 1.4 to 2.4), and dietary change (OR: 1.9; 95% CI: 1.5 to 2.5) were higher in individuals with nonzero CAC versus zero CAC scores, but not for aspirin or blood pressure–lowering medication continuation. When assessed within individual studies, these findings remained significant after adjustment for baseline patient characteristics and cardiovascular risk factors.

CONCLUSIONS This systematic review and meta-analysis suggests that nonzero CAC score, identifying calcified coronary plaque, significantly increases the likelihood of initiation or continuation of pharmacological and lifestyle therapies for the prevention of cardiovascular disease. (J Am Coll Cardiol Img 2017;10:833–42) © 2017 by the American College of Cardiology Foundation.

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ABBREVIATIONS AND ACRONYMS

ASA = aspirin

BPLM = blood pressure lowering medication

CAC = coronary artery calcium

CAD = coronary artery disease

CI = confidence interval

LLM = lipid lowering medication

OR = odds ratio

RCT = randomized controlled trial

RR = relative risk

The presence of calcified coronary plaque detected on cardiac computed tomography has been shown to be a strong predictor of future major adverse cardiovascular events among asymptomatic individuals, and it offers incremental risk stratification beyond traditional risk factors and risk scores endorsed by national guidelines (1–3). Coronary artery calcium (CAC) testing offers the potential to promote more aggressive pharmacological and lifestyle therapies among individuals with an elevated CAC score who are thus at increased risk for adverse cardiovascular events (4–6).

A meta-analysis by Whelton et al. (7) examined 4 randomized controlled trials (RCTs) to investigate the impact of CAC screening on risk factor modification (7). They found a nonsignificant trend toward reduction in blood pressure, lipid levels, and smoking cessation among individuals who had a CAC scan compared with those who were managed by standard care (7). However, in the EISNER (Early Identification of Subclinical Atherosclerosis by Noninvasive Imaging Research) study (8), when these findings were evaluated within the group that had a CAC scan, there was a significant increase in the initiation of aspirin (ASA), lipid lowering medication (LLM), and blood pressure-lowering medication (BPLM) among individuals with a nonzero CAC score (8). This would imply that having an abnormal CAC score, rather than merely undergoing the scan, accounts for behavioral changes.

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Prior observational studies have similarly suggested a correlation between the presence of CAC and initiation of ASA, LLM, and BPLM as well as increased exercise and dietary changes (9,10). However, to our knowledge, no studies have summarily evaluated the impact of presence versus absence of CAC on cardiovascular preventive therapies. As such, we conducted a systematic review and meta-analysis to evaluate the impact of nonzero versus zero CAC scores on initiation and continuation of pharmacological and lifestyle therapies for prevention of cardiovascular disease.

METHODS

The systematic review and meta-analysis was conducted and reported in accordance with recommendations of the MOOSE (Meta-analysis Of Observational Studies in Epidemiology) Group (11).

DATA SOURCES AND SEARCH STRATEGY. We performed a systematic search of published data using PubMed, EMBASE (Excerpta Medica database), Web of Science, Cochrane Central Register of Controlled Trials, ClinicalTrials.gov, and the International Clinical Trials Registry Platform from their inception through November 21, 2016. We used free text and medical subject headings terms to represent CAC and preventive therapies, including ASA, BPLM, LLM, smoking, exercise, dietary changes, and weight loss. We set no limitations on age, type of study, or language. The search strategy is shown in the Online Appendix.

STUDY SELECTION. Studies that evaluated the influence of CAC scores on downstream lifestyle modifications or medication usage for primary prevention of cardiovascular disease were eligible for inclusion. After removing duplicates, 2 independent reviewers excluded articles that were not relevant to the study and identified papers of interest based on titles and abstracts. Full-text reviews of relevant papers were then performed to identify eligible studies. References of the included papers were also screened to identify other potential papers of interest. Any disagreements on study inclusion or exclusion were adjudicated by the senior author (R.B.).

DATA EXTRACTION AND QUALITY ASSESSMENT. Two reviewers (A.G. and R.V.) independently extracted data from the included studies. If a study of interest had evaluated the effect of CAC score on preventive lifestyle or pharmacological therapies, but the categorization of CAC score was such that data on patients with zero versus nonzero CAC could not be extracted, then the corresponding author was contacted to provide data in zero versus nonzero CAC categories for inclusion in the meta-analysis. Such a study was excluded only if the corresponding author was unable to complete the data request. If multiple publications existed from the same cohort of patients

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