Coronary Calcification and Coronary Artery Disease

Gottlieb et al. (1) report computed tomography (CT) calcium scores in 291 patients (73% male) being referred for coronary angiography. The majority (95%) had either intermediate or high pre-test probability of coronary disease, and 42 (19.6%) had presented as emergencies with unstable angina. The authors report a surprisingly low sensitivity of only 45% for a calcium score of 0 to predict the absence of 50% lesions, that led your editorialist (2) to question the incremental value of calcium scoring for diagnosing coronary artery disease (CAD). Yet, as stated in the editorial, the value of any diagnostic test is critically dependent on the population in which it is applied. Calcium scoring has been recommended as a useful rule-out in patients with a low probability of CAD, based on meta-analysis that yields sensitivity estimates in excess of 90%, higher than most other methods of noninvasive testing (3). The patient population in the Gottlieb et al. (1) study is quite inappropriate for challenging this recommendation based on their high pre-test probability, their pre-selection for cardiac catheterization, their male predominance, and their high rates of unstable presentation. It is unclear what added value a calcium score could possibly make to the diagnosis of CAD in this group. Nevertheless, among the Gottlieb et al. (1) population, we find clues to the real value of calcium scanning for CAD rule-out in the 8 patients with a low pre-test probability of disease and a zero calcium score, none of whom had angiographic CAD. At present, we are often prepared to base diagnostic decisions in such patients on treadmill stress testing despite its low sensitivity (4) and negligible incremental value for risk assessment (5). It is in this low-risk population of patients with stable chest pain and a low pre-test probability of CAD that calcium scoring is likely to find its place as a simple and safe means for disease rule-out in clinical practice.

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REFERENCES


Coronary Calcium Remains an Effective Filter for Invasive Angiography

Gottlieb et al. (1) question the current guidelines in regard to coronary calcium scoring (CCS) in symptomatic persons and suggest their small study trumps 25 years of published literature. Coronary artery calcium (CAC) guidelines are written based on >1,000 studies, including several that were 5 to 10 times larger than the cohort reported. Furthermore, the authors excluded 89 patients who were enrolled in CORE64 (Coronary Evaluation Using Multi-Detector Spiral Computed Tomography Angiography Using 64 Detectors) who had CAC >600. Imagine a paper stating hypertension does not correlate with left ventricular hypertrophy, but the study inconspicuously eliminated patients who had significant hypertension.

The real issue is that CORE64 is divergent from almost all CAC literature. Almost every published study of CAC, including 2,000+ participant multicenter trials undergoing CAC and invasive angiography, demonstrate high sensitivity (>90%) and lower specificity (<50%) (2). Sarwar et al. (3) demonstrated a sensitivity of 98% for CAC to detect obstructive disease among 10,355 symptomatic patients with a 56% prevalence (identical prevalence to Gottlieb et al. [1]). Results from the first multicenter 64-slice computed tomography angiography (CTA) trial demonstrated CAC sensitivity of 94% and specificity 42% for >50% stenosis by quantitative coronary angiography (4). Gottlieb et al. (1) present the opposite results (sensitivity 45% and specificity 91%), calling into question study design, equipment, or CAC methodology, not validity of CAC testing. Hypotheses why the Gottlieb et al. (1) study diverges from the CAC literature include: threshold for CAC (attenuation >130 Hounsfield units [HU], developed for electron beam tomography [2], not validated for Aquilion 64 [Toshiba Medical Systems, Otawara, Japan]), pixel size (requiring larger minimum area for CAC results in lower sensitivity, methodology not reported in Gottlieb et al. [1]), patient selection (including acute coronary syndrome [ACS], known coronary artery disease [CAD], and prior revascularization), or other technical scanner issues (filters, reconstruction kernels). It has been demonstrated that different scanners have different operating characteristics and different CAC reproducibility (5). A CAC threshold of 110 HU was suggested for multidetector computed tomography (MDCT) scanners, and this simple methodological correction may yield more typical results (2).

Surprisingly, the authors went beyond the scope of their study to discuss prognostic implications. CAC prognostic studies have reported on follow-up of over 100,000 patients, clearly demonstrating a zero score carries excellent long-term prognosis (2,3). We followed patients for 8 years after emergency room admission, and patients with zero scores experienced coronary events (3), and 7 studies followed 3,924 symptomatic persons over 42 months, demonstrating CAC safety and efficacy. A recent CAC study followed 1,031 patients after hospitalization for chest pain (6).