The Promise of a Warranty

Udo Hoffmann, MD, MPH

Type 2 diabetes mellitus is among the most powerful independent risk factors of the cardiovascular disease presence and is associated with a 3 to 5x higher cardiovascular event risk. This has long been recognized by the National Cholesterol Education Program report in the United States and European guidelines, both labeling type 2 diabetes mellitus a coronary artery disease (CAD) equivalent. Although ever since the original publication by Haffner et al suggesting that asymptomatic patients with diabetes mellitus have the same cardiovascular risk as patients with previous myocardial infarction, a controversy has been raging as to whether indeed all patients with diabetes mellitus are equal.

See article by Valenti et al

During the past 20 years, large cohort studies, including the Framingham Heart Study and the Multiethnic Study of Atherosclerosis along with registries alike, have demonstrated that patients with diabetes mellitus are not a homogeneous risk cohort and as individuals are at different levels of risk of clinical events, including mortality.

The same can be said for atherosclerotic disease. Indeed, the study by Valenti et al in this issue of *Circulation: Cardiovascular Imaging* assessed the amount of coronary artery calcium (CAC) as a measure of subclinical CAD and found that ≤30% of patients with diabetes mellitus are free of subclinical CAD. Moreover, the increased risk of clinical events in diabetic patients closely tracks with an increased prevalence and extent of CAD when compared with nondiabetics, including CAC, nonobstructive plaque, and significant stenosis. For example, the risk of cardiovascular events increases from a hazard ratio of 5 for nonobstructive CAD to a hazard ratio of 12 for obstructive CAD. Equally if not more important were suggestions of previous studies that patients without subclinical CAD have a low risk of future clinical events for a period of 5 years subsequent to imaging similar to individuals without diabetes mellitus and hence may not meet criteria for high-risk asymptomatic patients.

The study by Valenti et al expands the time horizon on the prognostic value of the absence of CAC to a long-term 15-year perspective for all-cause mortality. Specifically, the study reports that among 9715 asymptomatic individuals undergoing CAC scoring, the mortality rate for patients without CAC is low for both those with (2.55% [1.22%–5.26%]) and without diabetes mellitus (1.24% [0.96%–1.61%]) at 5 years. However, the mortality rate increased to much greater extent in patients with diabetes mellitus (11.67% [8.26%–16.34%]) when compared with those without diabetes mellitus (4.53% [3.92%–5.23%]) after 15 years.

On one hand, the data to some extent rehabilitate the notion of diabetes mellitus as CAD risk equivalent as they demonstrate a detrimental effect of diabetes mellitus in the long term even in those without subclinical CAD at baseline. On the other hand, the data suggest that a calcium score of 0 predicts a low risk (akin to a warranty period) for ≤5 years in patients with diabetes mellitus and ≤15 years in those without diabetes mellitus. Thus, probably the most important implication of these data is that adequate intervals for observation for subclinical CAD may be 5 years in patients with diabetes mellitus and 15 years in those without. This represents a pragmatic example of how phenotyping of disease could shape a more personalized approach toward risk management. Of course, enabling a personalized cardiovascular prevention approach in patients with diabetes mellitus is much more complex and goes beyond time points for assessment of subclinical CAD, including controversies whether such imaging would be reasonable to evaluate indications for medical therapy (eg, considering secondary instead of primary prevention in patients with diabetes mellitus who have subclinical CAD).

Moreover, diabetes mellitus is a complex disease as, for example, the increment in risk of clinical events in women with diabetes mellitus compared with women without diabetes mellitus is 2x greater than the increment in risk for men with the disease. Although many of the reasons for both the excess risk in general or for the greater incremental risk in women remain unclear, one of the emerging mechanisms linking diabetes mellitus and atherosclerosis is increased inflammation. In the Women’s Health Study, elevations in high-sensitivity C-reactive protein predicted the development of diabetes mellitus and were a strong predictor of cardiovascular events independent of traditional risk factors. Another pathway that links diabetes mellitus with cardiovascular events may be chronic myocardial injury perhaps because of microvascular disease. Newly available highly sensitive troponin assays, reflecting myocardial cell damage well below the threshold for myocardial infarction, were 2.5x higher in participants with diabetes mellitus when compared with normoglycemic participants, and increasing highly sensitive troponin values were associated with major adverse cardiac events independent of traditional cardiovascular risk factors (adjusted hazard ratio, 2.3–6.0). These data present a strong motivation to
gain more insights into the multifaceted conditions potentially mitigating increased cardiovascular risk in diabetes mellitus.

Overall, there is an important need to improve preventive cardiovascular risk management for diabetic patients. The work by Valenti et al\(^2\) represents an important first step using phenotyping of subclinical CAD with CAC scanning. Moreover, the study further strengthens the notion that CAC is a measure that reflects the cumulative assault of atherosclerotic risk factors on the coronary arteries. Efficacy trials comparing imaging- and nonimaging-guided prevention strategies in diabetic patients would provide the ultimate proof of whether imaging could indeed be beneficial and affordable.

**Disclosures**

Dr Hoffmann reports receiving grants from American College of Radiology Imaging Network, HeartFlow Inc, and from Siemens Healthcare on behalf of his institution.

**References**


**Key Words:** Editorials ◼ cardiac imaging techniques ◼ cardiovascular diseases ◼ diabetes mellitus ◼ risk
The Promise of a Warranty
Udo Hoffmann

_Circ Cardiovasc Imaging_. 2016;9:e004389
doi: 10.1161/CIRCIMAGING.116.004389

_Circulation: Cardiovascular Imaging_ is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2016 American Heart Association, Inc. All rights reserved.
Print ISSN: 1941-9651. Online ISSN: 1942-0080

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circimaging.ahajournals.org/content/9/2/e004389

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in _Circulation: Cardiovascular Imaging_ can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to _Circulation: Cardiovascular Imaging_ is online at:
http://circimaging.ahajournals.org//subscriptions/