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EDITORIAL COMMENT

Imaging for Improving Therapy

A Stop on the Way to Improve Outcomes?*

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Knowledge and timber shouldn't be much used till they are seasoned
—Oliver Wendell Holmes (1)

Despite rapid advances in diagnosis and greater availability of effective cardiac therapies, utilization rates for these evidence-based treatments have been suboptimal in most cardiac conditions. Less than optimal rates of drug prescription, use, and adherence contribute to this problem. Multiple studies, including the REACH (Reduction of Atherothrombosis for Continued Health) registry involving 67,888 patients, confirmed a concerning underutilization of many drugs shown to favorably alter

See page 574

cardiovascular outcomes (2). Various strategies have been proposed to improve evidence-based drug prescription and adherence, but most have had only modest success. Because a visual picture may be worth many thousand words of oral or textual description, 1 strategy that has evoked great interest is to use cardiac imaging to detect subclinical disease; moreover, displaying graphic evidence of coronary artery disease (CAD) that is likely to cause high-impact events in patients without evidence of CAD, may impact physician–patient behavior positively. Imaging not only provides a very refined risk assessment in CAD, but also offers detailed visual information of coronary pathology, including changes in the coronary wall—information not easily available with other modalities; such combined information might overcome some of the current limitations in medication use and adherence. There is preliminary evidence that visual images improve understanding of a threat, increase believability of the risk information, and encourage risk behavior modification (3). Studies with coronary calcium imaging show a benefit in terms of increase in statin use (4,5). Computed tomography angiography (CTA) (which presumably would be used in a "for-cause testing" population with an enriched pre-test probability compared with coronary calcium screening studies), with more detailed information, might be similar or better in changing physician–patient behavior. A study in this issue of *iJACC* is one such effort to study the effect of a positive coronary CTA scan on prescription patterns and change in cardiovascular risk factors. Cheezum et al. (6) retrospectively studied 1,125 patients without known CAD, low-risk scores, and mostly atypical chest pain coming for CTA. Pre- and post-CTA prescription patterns for aspirin, statins, and blood pressure medication (1 snapshot from databases in the 6 months pre- and post-CTA) and risk factors were evaluated. Similar to prior studies in symptomatic (7) as well as asymptomatic patients coming for screening (8), knowing CTA results increased the frequency of some appropriate prescriptions and resulted in improvement of lipid profiles. Not unexpectedly, the change was in proportion to the severity of the imaging abnormality. Similar to all other studies in this arena, the study was too small to evaluate outcomes.

Can Imaging Modify Physician and Patient Behavior?

Cardiac imaging in general results in increased therapy, and the increase is related to the severity of

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test results. This has been shown in many studies (4,5,9), many albeit mostly small and limited to single or few centers using multiple different imaging modalities and sources of data. Some studies directly worked on motivating the patient, whereas others had a more global strategy. Even in the positive studies, the magnitude of change in medication use still remains suboptimal, even in those groups with the highest risk. Nearly one-third of high-risk patients were not on guideline-recommended medications post-imaging in the SPARC (Study of Myocardial Perfusion and Coronary Anatomy Imaging Roles in Coronary Artery Disease) study (9), and use of medication diminishes with time following an imaging test (8). Data in patients with lower risk are limited and varied, including in asymptomatic and symptomatic patients. One recent, well-done study showed that coronary artery calcium scanning in 2,137 highly motivated, well-educated, middle-aged asymptomatic volunteers was associated with better risk factor profiles at a single time point 4 years later. Outcomes, although the study was not powered for this endpoint, were not different (4).

However, results have not been unanimously consistent, especially in some of the more robust studies. A good-sized randomized trial using myocardial perfusion imaging in diabetic patients found that imaging did not markedly change the use of appropriate therapy (10). An older randomized study in active duty military personnel (somewhat similar risk as in the current paper (6), but younger age) did not show any benefit, in terms of altering modifiable risk, by their knowing whether they had coronary calcium or not. Although intensive case management helped in lowering modifiable risk, knowledge of coronary calcium did not add to it (11). Finally, another well-done randomized study of carotid plaque imaging failed to change smoking cessation rates or risk factor profiles even in motivated subjects (12). Notably, the test was positive in 58% of the subjects, thus avoiding the criticism of other studies that one cannot motivate a change in behavior if there is no high-risk indictor to start with. As a comparison, only 15% had a positive electron beam computed tomography scan in the O'Malley et al. study (11), and only 9% had >50% stenosis (and 55% had no CAD at all) in the current study (6). In a meta-analysis of 7 studies, intervention failed to show that cardiovascular imaging significantly influenced drug use, smoking cessation, or diet changes (13) but also demonstrated the scarcity of high-quality data addressing these issues. Despite imaging's attractiveness, its ability to refine cardiovascular risk, and encouraging current data, many limitations, including the use of highly selected patient populations, low prevalence of abnormal findings, and a lack of outcome data, preclude the drawing of firm conclusions on its broader utility for patient motivation or modifying physician prescription behavior. Some of these studies did not involve the patient's physician directly, did not suggest a pre-defined path for intervening, and the endpoint depended on recall or a long latency in follow-up, to a time point 4 years later. Typically, the effects of short-term counseling do not persist so long, and factors other than counseling might have played a role. Not surprisingly, given all these limitations, some have argued against widespread adoption of imaging to change behavior (14).

The present study (6), despite being retrospective, has some novelty even with the prior presence of at least 3 other studies. The authors used information from clinical indication–driven CTA in a larger group of patients than in many prior studies. Second, the patient population was unique in that the subjects were confined to 1 insurance system with generous benefits, and all their medical data were largely captive within that health system. Unlike previous studies, this study did not need to use recall or similarly less robust strategies to capture data (5). Finally, they were not subject to the confounding influence of variable levels of insurance and drug availability.

Does Using Imaging to Modify Physician and Patient Behavior Change Outcomes?

Even with many studies showing some benefit of cardiovascular imaging in modifying physician and patient behavior, one important unanswered question is whether CTA information just provokes more action, or whether the action is associated with better outcomes. It is worthwhile to remember that sometimes efforts at more intensive case management, based on a limited set of indicators, have resulted in adverse outcomes despite overwhelming benefit shown in small preliminary studies (15). Surrogate measures such as increased medication use or adherence to a prescription strategy may not reveal what will happen in the long run. Similarly, studies in other fields have shown that increased adherence and behavior change with intervention did not necessarily change outcomes (16). Primary prevention studies are notoriously affected by low event rates and need a very large number of patients to show a benefit—indeed, even the 2,137 patients in the EISNER (Early Identification of Subclinical