Role of Electron-Beam Computed Tomography

"The most savage controversies are about subjects in which there is not much evidence either way." …. Bertrand Russell

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In this *Heartbeat* Dr. Howard Weinberg and I will examine the controversy about the value of electron-beam computed tomography (EBCT) as a tool for accessing the efficacy of therapy for heart disease prevention. EBCT is a highly sensitive, accurate, non-invasive and quantitative technique for detecting coronary artery calcium (CAC). This is expressed as calcium scores, which are highly correlated with atherosclerotic plaque burden and the risk of future events. EBCT helps identify sub clinical coronary artery disease (CAD) and could be a powerful tool for the prevention of heart disease.

Pro:
The best use of EBCT is for intermediate-risk patients to identify individuals at lesser, equal, or greater risk than that based solely on application of conventional "risk" models (Framingham). A negative EBCT test makes the presence of atherosclerotic plaque, including unstable plaque, very unlikely. A negative test is highly unlikely in the presence of significant luminal obstructive disease. Coronary calcium screening is probably unnecessary when patients are either very low or very high risk, as the appropriate

therapeutic approach is often clear from symptoms and conventional risk factors.

EBCT is being used increasingly to screen and assess three groups of patients so that more aggressive therapy can be utilized for prevention:
1) Asymptomatic individuals at intermediate-to-high risk of developing cardiovascular disease (CVD),
2) Symptomatic individuals at low-to-intermediate risk of coronary events, and
3) Patients with known CAD to assess progression or regression of disease.

Con:
Unfortunately, calcium screening is an expensive test that is not covered by insurance, and its role in heart disease prevention is yet to be determined. Existing modalities such as exercise testing, perfusion scintigraphy, and exercise echocardiography are extraordinarily well validated with respect to prognostic implications. When exercise testing is used appropriately in conjunction with risk stratification, calcium screening adds nothing that would alter the plan of action.

In order to assess the role of EBCT-calcium screening a little further, Dr. Weinberg and I will each address these three questions:

I. Why is measuring CAC important?

Pro:
A) It is the best way to detect coronary atherosclerosis in the asymptomatic patient.

B) CAC today correlates with cardiac events tomorrow.
C) In intermediate-risk patients a calcium score above the 75th percentile for age and gender—a cutoff that accounts for some 70% of coronary events—can tip the balance when deciding whether to initiate aggressive preventive therapies.

Con:
A) Almost 80% of MI's occur in patients with high-risk vulnerable plaque that is not identified by EBCT.
B) This costly study adds little to our already aggressive risk factor identification and preventive treatment programs.

II. Is the presence or absence of CAC useful for primary prevention, i.e. in asymptomatic patients with or without known risk factors?

Pro:
The prognostic potential of EBCT is realized by the fact that the greater the calcium scores, the greater the amounts of lipid-rich and potentially unstable plaques in the same vessels. The detection of CAC in the symptomatic or asymptomatic patient offers incremental prognostic information over traditional risk factors. It is useful in motivating both patient and physician to treat all known risk factors aggressively or to search for emerging risk factors (homocysteine, lipoprotein (a), or High-Sensitivity C- Reactive Protein).

Con:
The present guidelines for ID and treatment of risk factors are already very aggressive, as these case scenarios illustrate:

1) No CAC detected by EBCT. Elevated LDL, low HDL, high BP, diabetes mellitus (DM), high homocysteine, and patient smokes and is overweight.

Treatment Plan: Treat aggressively with statins and possibly niacin or a fibrate, BP lowering agents, DM control, folic acid, smoking cessation, therapeutic lifestyle changes (TLC)—exercise and weight reduction. Perform the appropriate exercise testing to rule out flow limiting disease, even though no CAC is detected.

2) Identical to the first, except positive CAC detected per EBCT.

Treatment Plan: Same as above.

3) Positive CAC, low LDL, high HDL, normal BP, no DM, normal homocysteine, does not smoke and is not overweight.

Treatment Plan: None except possibly TLC. Appropriate exercise testing might be considered although there is very low probability of finding flow -limiting CAD.

4) Positive CAC, normal lipids, high BP, and DM.

Treatment Plan: Control BP and DM, TLC and add statins and aspirin, same as if CAC were negative. Appropriate exercise testing is recommended.

5) A 45 year old asymptomatic male with strong positive family history, LDL-130, HDL-40, TG-175.

Treatment Plan: An appropriate stress test to rule out flow-limiting disease and treatment with TLC, aspirin and a statin, and possibly niacin, to increase HDL. Detectable CAC would not change this already aggressive treatment plan.

III. What is the value of measuring CAC in a patient with known CHD?

Pro:
EBCT could accurately track disease

progression and calcium accumulation or regression, and more accurately determine the need for more aggressive treatment.

Con:
These are high-risk patients and should be treated aggressively, per ACC / AHA guidelines, using the ABCDE'S: **A**nti-thrombotics, **B**eta- blockers, **C**onverting enzyme inhibitors, **D**iet and **D**o not smoke recommendations, **E**xercise and **S**tatins, regardless of the presence or absence of CAC. The proven additive benefits of these treatments should be incentive enough to treat patients aggressively. It is a waste of money to look for CAC, another risk factor, especially in this scenario.

SUMMARY / CONCLUSION

Pro:
In many cases the calcium score can provide that additional push to stimulate both the doctor and patient to treat aggressively. Obviously we don't have all the answers. If we randomly screen asymptomatic patients with EBCT, the vast majority (~85%) will have insignificant atherosclerosis. Those with high scores will have at least one risk factor and tend to be associated with high LDL-C levels, but not in all cases.

High LDL-C = high calcium (but not always). It's the "not always" that is disturbing (even though a small percentage). There will be no correlation with fitness or functional capacity. Stress testing could be unremarkable. The absolute magnitude of the calcium score won't be predicted by the degree of risk factor abnormalities. EBCT should be added to the evaluation of individuals determined to be at intermediate risk to assist in clinical decision-making regarding the use and intensity of risk-reducing therapies. It's another tool to assist in risk stratification of people with a strong family history of CHD, whose risk factor profiles are unremarkable or in convincing those who resist aggressive therapy to understand the seriousness of their disease and to start therapy. The calcium score can guide the initiation of therapy in those determined to be at highest risk and limit or delay initiation of expensive treatments with some downside risk, in patients determined to be at lowest risk.

Con:
Identifying CAC in the 75th percentile identifies risk for CHD. EBCT does not identify high-risk vulnerable plaque, but it certainly identifies patients who are at high-risk to have vulnerable plaque by quantifying overall plaque burden. Patient selection is the key to making the best use of any diagnostic test—including EBCT. The question you always have to ask and answer is this—*will it make a difference in how you're going to treat the patient?*

Detecting calcium in the coronary arteries is simply not good enough. Identifying risk, aggressive risk-factor modification and attempts to identify flow-limiting stenosis with any of the available stress tests and then instituting the appropriate intervention are the best ways to assess and manage the asymptomatic patient, the symptomatic patient, or the patient with proven CHD—the majority of the time. Using ACC/AHA guidelines is usually enough, and EBCT is redundant. A case can be made for calcium screening in the patient with a strong family history of CHD and nothing abnormal to treat. Then, even a low calcium score should give us justification to look for emerging risk factors and treat aggressively.

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Heartbeats can be found at www.sjhg.salu.net under Patient Education, then From Your Physician.