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# *Letter to the Editor*

## **Comment on Electron Beam Computerized Tomography**

### **Dear Editor,**

In the past several years, controversy has loomed over the use of electron beam computerized tomography (EBCT) in the detection of plaques in the coronary arteries. While it has become fashionable among the lay public, many attracted by prominent and smart advertisements posted on public buses etc., responses from cardiologists, especially those working in academic centers, have remained skeptical to lukewarm. This has been the phenomenon internationally as well as in Hong Kong.

There is little disagreement that EBCT is able to detect calcium in the coronary artery, and that the presence of calcium indicates atherosclerotic plaque. As such, it can be regarded as a surrogate marker for coronary artery disease. However, it is well known that any surrogate marker or risk factor such as hypercholesterolemia or hypertension detected in any individual does not necessarily indicate an immediate risk of an impending heart attack. In the vast majority of people, the atherosclerotic process is a slow and insidious process, and people with atherosclerotic plaques may remain symptom-free for years or even decades, before clinical manifestations develop in the form of angina, unstable angina, acute coronary syndrome, myocardial infarction or heart failure. If EBCT is going to be a useful test for asymptomatic individuals, it should be able to predict near-term future events in patients at risk. It should also be able to supercede other readily available and relatively inexpensive clinical data collection such as age, gender, cigarette smoking, blood pressure, or laboratory measurements of LDL-cholesterol, glucose etc. by offering an incremental value to the risk assessment by the Framingham and National Cholesterol Education

Program risk factor determination.<sup>1</sup> The published literature, however, does not support the claim that EBCT can offer additional value to conventional risk factor assessment as above-mentioned.<sup>2</sup>

Various investigators have, in the last decade, reported the sensitivity, specificity and predictive accuracy of EBCT, as compared to coronary angiography, the diagnostic gold standard. For example, Rumberger et al<sup>3</sup> reported, out of a total of 251 patients, a true positive of 176, a true negative of 29, a false negative of 1 and a false positive of 45. The overall sensitivity was very high at 99.84%, but the specificity was very low at 25.7%, yielding an overall predictive accuracy of 81.7%. In another study, Kennedy et al<sup>4</sup> reported in 1998 out of 368 patients a true positive of 151, true negative of 64, false negative of 7 and false positive of 146, yielding a sensitivity of 95.6% and a specificity of 30.5%. The overall predictive accuracy was 58.4%. In an attempt to pool the published data from the literature, a meta-analysis was performed by the American College of Cardiology Task Force on Clinical Expert Consensus Documents.<sup>5</sup> A total of 3683 patients were pooled from 16 studies. The sensitivity ranged from 67.9% to 100% with a weighted average (adjusted according to sample size since some of the study populations were rather small) of 80.4%. The specificity ranged from 21.4% to 100%, with a weighted average of 39.9%. The predictive accuracy ranged from 40.9% to 94.9%, with a weighted average of 59.1%.

From such meta-analysis, one can see that EBCT, limited by its present technology, is highly sensitive in detecting calcified plaques, but not specific or accurate in so far as the diagnosis or the staging of clinically significant coronary artery disease is concerned. Despite the high sensitivity, the high false positive rates often induce unnecessary anxiety, and even panic in some cases. Among individuals who may not be at risk for coronary events in the near term, many of these do go on to further investigations such as myocardial isotope scanning, cardiac magnetic resonance perfusion study or even coronary angiography, only to find out that many

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of them turn out to have no significant coronary artery disease. The premise of EBCT is thus defeated.

Furthermore, there is increasing evidence from the literature that inflammation of the arterial wall covering the plaque plays a very important role in causing heart attacks by acute rupture of plaques that are often, in as many as 50% or more of the cases, soft and fatty, rather than hard or calcified.<sup>6</sup> Many cardiologists believe that as plaques become calcified, the vessel lumen actually expands via a process of remodeling. In fact, calcification may even act as a lattice, holding the plaque in place and preventing the plaque from rupturing.<sup>7</sup> Calcium in the walls of the artery may be protective in a sense, and not really such an alarming signal after all! Researchers are now racing to find an imaging technique that will detect such "vulnerable" or "hot" plaques. When such a technique is indeed in place, and proven clinically relevant and useful, assessment of calcium scores could become moot or obsolete.

False negative rates are fortunately low, but albeit the small number, this is a group of patients not to be taken too lightly, since they are a high risk group of patients, who are not likely going to see cardiologists until such times when they develop acute coronary syndrome or myocardial infarction, having been "falsely" reassured. They are, therefore, at double risk.

In the last issue of the journal,<sup>8</sup> Thomson and White's article: "The Role of Ultra-fast Computed Tomography in the Assessment of Coronary Disease" is well written and timely. The authors have done a critical analysis of the use of EBCT as a screening tool for asymptomatic patients, as a diagnostic evaluation for patients with symptoms of coronary artery disease, and as follow-up evaluation for patients with known coronary artery disease. This highly informative paper should offer the clinician a welcome and useful guide

to the current use and limitation of EBCT in clinical practice. Physicians should exercise caution in the interpretation of the EBCT calcium scores, taken into consideration that this technology is still new and far from perfect. There is much room for further research in this area.

Yours faithfully

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