

Coronary CT Angiogram versus Stress Testing: Is the Debate Real?

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Accurate diagnosis of coronary artery disease (CAD) has always remained an area of immense interest for cardiology community. Though, invasive coronary angiography (ICA) has remained gold standard for anatomic diagnosis of CAD, there are continuous attempts to develop non-invasive approaches with high fidelity. For years together, stress testing remained at forefront of non-invasive evaluation of CAD. However, in recent years, coronary CT angiography (CCTA) has been increasingly performed to evaluate patient with suspected CAD. A number of studies and trials have compared CCTA and stress testing, not only for diagnosis of CAD but also for prognostication. Certain reviews strongly recommended CCTA as first investigation for patients with stable chest pain syndrome with low to intermediate risk probability of CAD [1]. One step ahead, National Institute of Clinical Excellence (NICE) guidelines for stable chest pain patients recommended CCTA as first line investigation for all patients irrespective of their pre-test probability of CAD [2]. A number of factors were enumerated in favor of CCTA as compared to stress testing. Higher sensitivity and specificity of CCTA, better prognostic power, lower ultimate downstream cost, lesser radiation exposure and lesser incidence of future events in non-obstructive CAD patients were some of them. Data from PROMISE trial and SCOT-HEART trial formed a large proportion of evidence base of these reviews and recommendations. Increased mortality due to non-obstructive plaques identified by CCTA and benefit of statins in such individuals as claimed in CONFIRM registry was also mentioned as evidence in favor of CCTA [3].

If we compare the individual sensitivity and specificity of stress testing and CCTA, we find that CCTA scores higher than stress testing. However, on detailed analysis, we can see that majority of meta-analysis comparing stress testing with ICA were flawed due to variable definition of obstructive CAD [4]. Despite the fact that ACC guideline on chronic stable angina (2012) clearly mention that significant coronary artery disease is defined as 70% diameter stenosis in any epicardial artery except left main coronary artery (LMCA) for which the threshold is 50%, investigator continue to define coronary artery disease as presence of > 50% diameter stenosis in epicardial arteries [5]. Though, it has its own benefits we cannot expect stress testing to pick up lesions which are more than 50% in diameter stenosis but do not cause ischemia.

On careful analysis of PROMISE trial, one finds that event rate at 2 years was similar in two arms, one choosing stress testing and other choosing CCTA in subjects with low to intermediate risk of CAD. The event rate was similar despite the fact that more number of invasive coronary angiograms (ICA) and more revascularization procedures were performed in CCTA arm. Cumulative number of events (death, non-fatal myocardial infarction, hospitalization for unstable angina) was more in CCTA group than stress testing group, though it was statistically not significant [6].

Another trial, which has been quoted frequently in recent years, is SCOT-HEART trial which showed that use of CCTA with routine standard care was associated with increased certainty with which diagnosis of CAD could be made. It also led to change in plan of treatment. However, there was no significant difference in incidence of admission to hospital, myocardial infarction (MI) or severity of angina. More importantly, this was not a direct comparison between stress testing and CCTA. Authors clearly stated that they wanted to explore effect of addition of CCTA to stress testing rather than a head to head comparison. This is also evident from the fact that 85% of subjects in both of arms of trial underwent stress testing (Exercise ECG) [7].

A recent retrospective study from Holland compared CCTA with stress testing and found that CCTA use was associated with similar incidence of all-cause mortality at 3.6 years. However, there was decrease in incidence of myocardial infarctions (MI). The unadjusted rate of MI in CCTA arm was 0.8% as compared to 1.5% in stress testing arm. On the other hand, there were more co-morbidities at baseline in stress testing arm and overall downstream costs were 38% higher in CCTA group which was statistically significant [8].

There is another argument which emanated from findings of CONFIRM registry. Presence of non-obstructive plaques on CCTA is associated with higher mortality risk. Use of statin therapy in such individuals is associated with mortality benefit. On careful analysis, it is evident that individuals with non-obstructive plaque had higher incidence of cardiac risk factors, were older in age, were more likely to be male and had higher NCEP/ATP III risk score. Therefore, presence of non-obstructive plaques may only be a result of these risk factors already known to us, as also suggested by the authors. We are already prescribing statins to most such individuals as primary prevention. How does identifying such plaques by CCTA will have added advantage is not clear unless a large randomized controlled trial demonstrates benefit of statins in non-obstructive CAD patients who are otherwise not candidates for statin therapy. If we can really demonstrate in future that statin therapy for non-obstructive plaques causing 1%-49% diameter stenosis is beneficial, then how will we apply this information to society as a whole? Will we continue to give this benefit only to those who will approach health care system with suspected angina or will we subject all individuals above a particular age to CCTA? Any primary prevention strategy should be applicable to whole of society at a reasonable cost without any significant side effects; otherwise it will lose its utility. We have seen this in case of a number of cancers. Moreover, CONFIRM registry did not have data about medication use in 23% of subjects at beginning of study and no information was available about medication in follow-up period [3].

Another, much more important issue is that can we really compare anatomy with physiology? Are they really comparable or they should be complementary to each other. Even if we identify higher number of individuals with non-ischemia causing anatomically obstructive plaques, will it lead to change in management strategies? Are we going to fix all those plaques with angioplasty or surgery? Despite a large number of trials in this area, ACC guidelines clearly mention that there is no mortality benefit of angioplasty or bypass surgery in patients with chronic stable angina who do not have LMCA disease [5]. Is this not enough evidence, that anatomy alone will not help us in formulating best strategy? Beside there are other issues pertinent to fraternity as well as society. Cost of CCTA as compared to exercise ECG or echocardiography is one such issue. In developing countries like India cost of CCTA is ~ 150 USD while that of stress echocardiography is ~60 USD. There is a definite risk of radiation and contrast media use involved in CCTA which is not there in stress echocardiography. Exercise capacity, one of the best known prognostic indicators of cardiac as well as all-cause mortality, cannot be ascertained by CCTA. Moreover, CAD evaluation, a forte of cardiologists till now, will be slipping into hands of radiologists for their obvious better understanding of CT. Will it be an easy transition?

We may not be having all the answers as yet but surely we are not ready for totally replacing traditional stress testing based approach with CCTA. Newer techniques like CT-FFR (fractional flow reserve) may change the scenario in coming years but stress testing will remain an invaluable weapon in the armamentarium of cardiologists.

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