Coronary CT Angiography in the Evaluation of Acute and Stable Chest Pain: An Executive Summary of the Data Supporting Widespread Coverage and Utilization

The rising cost of healthcare is prompting numerous policy and advocacy discussions regarding strategies for constraining growth and creating a more efficient and effective healthcare system. Coronary CTA (CCTA) is well-validated, with nearly 20 large clinical trials, as an equally effective, if not superior, strategy to functional testing with regards to patient outcomes and, in some trials greater improvement in symptoms, without added costs.[1] Despite this evidence, the utilization and growth of CCTA remains suboptimal relative to the evidence for clinical efficiency compared to other imaging modalities.

Diagnostic Accuracy

The superior diagnostic accuracy of CCTA compared with invasive coronary angiography (ICA) and stress imaging modalities has been demonstrated in prospective trials, such as the ACCURACY Trial, Meijboom Trial, and CORE 64 trials demonstrated a diagnostic sensitivity of 85-99% and a specificity of 64-90% utilizing 64-slice multidetector CT (MDCT) platforms.[2, 3, 4] More contemporary trials including the EVINCI Trial and the PICTURE Trial showed higher sensitivities and specificities of CCTA compared with functional stress testing modalities.[5, 6]

Clinical Outcomes – Stable Chest Pain

Multiple prospective, randomized trials have demonstrated net improvement in diagnostic certainty, initiation of preventive medications, and subsequent reduction in hard cardiovascular endpoints when utilizing CCTA compared with standard of care. The **CAPP trial** demonstrated that patients randomized to CCTA had an improvement in angina stability and overall quality of life as compared to exercise testing.[7] The **PROMISE trial** demonstrated that at three years, a composite of major cardiovascular events was similar for CCTA with similar three-year healthcare costs.[8, 9] The **SCOT-HEART Trial** demonstrated that at three years patients allocated to CCTA had numerically lower rates of coronary heart disease death, myocardial infarction (MI) with subsequent follow-up data demonstrating a 50% reduction in fatal and non-fatal MI.[10, 11] A subsequent **meta-analysis of the stable chest pain trials** demonstrated that CCTA was associated with a 31% reduction in annual MI rate compared to standard of care.[12] In addition, **CONFIRM Registry** with over 30 peer reviewed manuscripts has demonstrated that coronary CTA has effective risk stratification among a broad patient population encompassing racially and ethnically diverse patients with different risk factors.[13, 14, 15, 16, 17, 18] Finally, the **Dewey Trial** demonstrated that at three years, major cardiovascular outcomes were similar between direct ICA compared to CCTA.[19]

Clinical Outcomes – Acute Chest Pain

The safety and efficiency of CCTA in the emergency department (ED) in the evaluation of low-intermediate risk patients with acute onset chest pain has been validated in three large prospective studies. The **ACRIN-PA Trial** demonstrated that coronary CTA was associated with a higher rate of discharge from the ED, had a higher rate of detection of CAD, and following a negative CCTA no patient died or had an acute MI.[20] The **ROMICAT II Trial** demonstrated that in patients allocated to CCTA, without signs of an acute coronary syndrome, the length of stay was reduced by 7.6 hours with no significant differences in major adverse cardiovascular events.[21] The **CT-STAT Trial** demonstrated that, compared to myocardial perfusion imaging, the time to diagnosis was shorter for coronary CTA with no differences in major adverse cardiovascular events following a negative study.[22, 23] A subsequent meta-analysis of **Clinical Outcomes after CCTA in the ED** demonstrated that CCTA was associated with decreased costs and length of stay but increased ICA and revascularization.[24]

CCTA in Societal Guidelines

The 2012 ACC/AHA Stable Ischemic Heart Disease guidelines assign a class IIA recommendation for CCTA in low-intermediate risk patients who are unable to exercise or have an uninterpretable ECG.[25] Furthermore, CCTA is considered class IIA in patients with prior inconclusive functional testing or ongoing symptoms.[25] The 2011 ACC/AHA Unstable Angina/NSTEMI guideline gives CCTA a class IIA recommendation in low-intermediate risk patients with suspected ACS and a normal or nondiagnostic cardiac biomarker and ECG.[26] Both of these statements were published prior to the vast majority of large, prospective stable and acute chest pain trials previously discussed, thus the level of recommendation may increase in future iterations.

Radiation Considerations

The widespread implementation of prospective, ECG-triggered acquisition protocols has significantly reduced per-patient radiation exposure for CCTA. These recommendations were codified in a SCCT guideline statement on radiation dose optimization.[27] Essentially all prospective trials comparing CCTA to SPECT imaging have demonstrated a significant dose reduction when utilizing CCTA. Notably, this difference was seen when utilizing older, 64-slice MDCT platforms.[8, 21, 23] All vendors have subsequently released various solutions that even more dramatically reduce dose to the point where CCTA can be performed for ~1-2 mSv in select patients.[28,29]

Economic Impact of CCTA

The concept of value-based imaging dictates that the optimal imaging guided strategy is one of the highest quality evidence demonstrating clinical effectiveness but at similar or reduced costs for a given strategy of care. Important considerations for any cardiovascular imaging modality would be how it will affect therapeutic decisions, downstream testing, and cost. Along with the comparative effectiveness evidence, abundant data are available with regards to the cost efficiency of CCTA[9, 30, 32] Data from the PROMISE trial revealed no

differences in costs of care at three months through three years of follow-up and in the SCOT-HEART trial, cumulative six-month costs were slightly higher for coronary CTA but overall differences in costs were not statistically different from the standard of care arm of the trial.[8, 11]

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