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Review article

Cardiac computed tomography in current cardiology guidelines

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ABSTRACT

Practice guidelines issued by professional societies significantly impact cardiology practice throughout the world. They increasingly incorporate cardiac CT imaging. This review systematically analyzes clinical practice guidelines issued by the American College of Cardiology Foundation (ACCF)/American Heart Association (AHA) and the European Society of Cardiology (ESC) as well as the multi-societal appropriateness criteria in their latest versions as of September 1st, 2015, in order to identify the extent to which they include recommendations to use cardiac CT in specific clinical situations.

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Guidelines issued by professional societies have substantial impact on cardiology practice. Such guidelines are included in performance measures aimed to improve the quality and cost-effectiveness of care.[1, 2] Professional society guidelines are typically revised every few years in order to address advances in healthcare technology and research.[3–7] However, new procedures, technologies and medications need to demonstrate safety and efficacy before they can be incorporated into new guidelines. Depending on the clinical impact and extent of improvement

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beyond existing measures, the strength of recommendation is graded from "Class I" to "Class III", and the level of evidence available to support such a recommendation is typically rated from "A" to "C" (Table 1). A recent analysis of the American College of Cardiology Foundation (ACCF)/American Heart Association (AHA) guidelines showed that the durability of these recommendations for procedures and treatments varies across individual guidelines and levels of evidence. Downgrades, reversals, and omissions are most common among recommendations not supported by multiple randomized studies (which would correspond to "Level of Evidence A".[1]

In this review, we systematically analyze clinical practice guidelines issued by the ACCF/AHA and the European Society of Cardiology (ESC) as well as multi-societal appropriateness criteria in their latest versions as of September 1st, 2015, in order to identify the extent to which cardiac CT is included.

1. Risk assessment in asymptomatic individuals

Cardiovascular risk assessment and primary prevention is an integral part of contemporary cardiovascular care. Clinical risk assessment tools, various versions of which are available from different professional societies, constitute the cornerstone of risk assessment.[8–10] The coronary artery calcium (CAC) score is a reliable, noninvasive technique for estimating overall coronary atherosclerotic burden and has been shown to accurately predict outcomes in multiple studies[11–14], better so than current risk scores, biomarkers and other imaging tools.[10, 15–17]

All the same, current guidelines do not recommend the widespread use of CAC scoring for risk assessment. The recent ACCF/AHA risk assessment guidelines concluded that among novel risk markers, assessment of family history of premature cardiovascular disease, as well as measurement of hs-CRP, CAC scoring, and ankle brachial index show some promise for clinical utility, but they fall short of recommending any of them for routine clinical risk assessment. Specifically, the ACCF/AHA 2013 guidelines on risk assessment give Agatston CAC scoring a "Class IIb" recommendation ("may be useful") in patients in whom statin therapy is not otherwise recommended within the guideline and who have an estimated 10-year atherosclerotic vascular disease risk between 5 and 7.5%. Conversely, the 2010 ACCF/AHA guidelines for assessment of cardiovascular risk in asymptomatic adults and the ESC guidelines published in 2012 state that determining the CAC score is considered reasonable in intermediate risk patients (10–20% 10-year coronary heart disease risk), assigning a "Class IIa" recommendation for truly intermediate risk and a "Class IIb" recommendation for low-to-intermediate risk individuals.[14, 18] The use of coronary calcium scanning for risk assessment of subjects with low estimated risk (<6% 10-year risk) is not recommended.[14]

2. Evaluation of acute chest pain in the emergency department

Acute chest pain is among the most common complaints in patients presenting to emergency departments. In many cases, standard evaluation of acute chest pain patients is prolonged, costly, and may involve non-invasive testing to definitively exclude acute coronary syndrome (ACS). However, the overall prevalence of ACS in patients who present with acute chest pain is low.[19, 20] Coronary CT angiography (CTA) has been rigorously evaluated in four randomized prospective clinical trials involving more than 3,000 patients for its safety and efficacy as compared to standard evaluation strategies in low-to-intermediate risk patients with acute chest pain.[21–24] These randomized clinical trials demonstrated that early coronary CTA performed in patients at low-intermediate pre-test likelihood for ACS is safe, significantly reduces time to diagnosis and discharge and is associated with lower cost. Coronary CTA may result in a slight increase (~2%) in the rate of invasive coronary angiography (ICA); however, it is unclear whether this increase represents more appropriate utilization of coronary angiography in patients who underwent coronary CTA or an underuse of ICA in patients undergoing non-CT evaluation strategies.[25]

Even before the large randomized clinical trials became available, the ACCF/AHA 2010 Appropriate Use Criteria for cardiac CT[14] (which are endorsed by multiple other societies) designated coronary CTA as appropriate for the early evaluation of appropriately selected acute chest pain patients with low or intermediate likelihood of ACS. More recently, the Society of Cardiovascular Computed Tomography (SCCT) published the first societal guideline defining the appropriate utilization of coronary CTA in patients with acute chest pain. The guideline specifies site equipment, training and staff requirements for the optimal performance of CTA in patients with acute chest pain. It also provides detailed recommendations for appropriate patient selection and preparation, scan performance, interpretation, reporting and post-test patient management based on CTA findings.[26]

In addition, coronary CTA is included as a diagnostic option in the AHA scientific statement on testing of low-risk patients presenting to the emergency department with chest pain[27]. The 2012 ACCF/AHA update of the non-ST-elevation myocardial infarction guidelines included coronary CTA as a diagnostic option without any specific class of recommendation.[28]

Most recently, the 2015 ESC guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation[29] recommend coronary CTA as an

Table 1
Class of recommendation and level of evidence as used by the American heart association, American college of cardiology foundation and European society of cardiology guidelines.

Class of recommendation	Explanation
Class I	Conditions for which there is evidence, general agreement, or both that a given procedure or treatment is useful and effective.
Class II	Conditions for which there is conflicting evidence, a divergence of opinion, or both about the usefulness/efficacy of a procedure or treatment.
Class IIa	Weight of evidence/opinion is in favor of usefulness/efficacy
Class IIb	Usefulness/efficacy is less well established by evidence/opinion.
Class III	Conditions for which there is evidence, general agreement, or both that the procedure/treatment is not useful/effective and in some cases may be harmful.
Level of evidence	
Level of evidence A	Data derived from multiple randomized clinical trials
Level of evidence B	Data derived from a single randomized trial or nonrandomized studies
Level of evidence C	Consensus opinion of experts