

Johns Hopkins University School of Medicine
Appropriate Use Criteria
Priority Clinical Area: Coronary Artery Disease and Unstable Chest Pain
Setting: Ambulatory and Emergency Department

INTRODUCTION

The purpose of this project was to evaluate the highest grade evidence in the literature pertaining to the utility of coronary computed tomography angiography (CTA) among outpatients and emergency department patients with suspected coronary artery disease (CAD), focusing on patient outcomes and costs and in keeping with high value practice.

LITERATURE REVIEW

Conducted Feb. 11, 2019

Katie Lobner, Welch Medical Library informationist, in cooperation with subject specialists, performed a broad search of literature from 1990 to the present to identify research investigations, systematic reviews and meta-analyses measuring the utility of advance imaging (CT, MRI or nuclear medicine) for CAD and/or chest pain.

("Coronary artery disease"[mh] OR "coronary arteriosclerosis"[mh] OR "acute coronary syndrome"[mh] OR "coronary artery atherosclerosis"[mh] OR "arteriosclerotic cardiac disease"[mh] OR "arteriosclerotic heart disease"[mh] OR "coronary atherosclerosis"[mh] OR "coronary arteriosclerosis"[mh] OR "coronary artery calcification"[mh] OR "coronary arterial calcification"[mh] OR "coronary artery obstruction"[mh] OR "coronary arterial obstruction"[mh] OR "coronary artery stenosis"[mh] OR "coronary obstruction"[mh] OR "coronary artery occlusion"[mh] OR "coronary arterial occlusion"[mh] OR "coronary artery acute occlusion"[mh] OR "coronary occlusion"[mh] OR "coronary artery thrombosis"[mh] OR "coronary thrombosis"[mh]) AND ("magnetic resonance imaging"[mh] OR "MRI"[mh] OR "MRI"[tiab] OR "tomography, X-ray computed"[mh] OR "CT"[tiab] OR "computed tomography"[tiab] OR "nuclear medicine"[mh] OR "radionuclide imaging"[mh:noexp] OR "radionuclide imaging"[tiab] OR "scintiscanning"[mh] OR "scintiangiocardigraphy"[mh] OR "perfusion imaging"[mh] OR "scintigraphy"[mh] OR "myocardial perfusion imaging"[mh] OR "radionuclide angiography"[mh:noexp] OR "radionuclide angiography"[tiab] OR "radionuclide ventriculography"[mh] OR "gated blood-pool imaging"[mh] OR "tomography, emission computed"[mh] OR "emission computed tomography"[tw] OR "positron-emission tomography"[mh] OR "positron emission tomography computed tomography"[mh] OR "tomography, emission-computed, single-photon"[mh] OR "cardiac-gated single-photon emission computer-assisted tomography"[mh] OR "single-photon emission computed tomography"[mh]) AND "randomized controlled trial" OR "meta-analysis" OR "systematic review"[pt] AND 2000:3000[dp] AND "eng[la]"

Inclusion Criteria

- Primary diagnosis of CAD (preintervention)
- Randomized controlled trial, systematic review or meta-analysis
- Evaluated effectiveness of cardiac imaging for CAD diagnosis, management and outcomes

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- Adult patients
- CT: 64 slice or higher
- MRI: 1.5 T or higher
- Nuclear medicine: standard cardiac tests
- Search for studies focused on women and underrepresented minorities

Exclusion Criteria

- Pediatric
- Pathology other than CAD — e.g., cardiomyopathy
- Post-treatment CAD
- Less common diseases, such as lupus
- Experimental imaging protocols (comparison of contrast doses, novel radionuclide agents, MRI protocols, etc.)
- No studies evaluating utility of premedication for CT, MRI or nuclear medicine
- Abstract detailing the protocol design prior to performing the randomized control trial

Additionally, clinical practice guidelines and consensus statements were identified using this search:

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Literature Search Results

Results from the search strategy were uploaded to Covidence and screened in duplicate by two radiology faculty members with subspecialty training in body imaging. Disagreements were resolved by consensus, followed by the same process for full text review.

PRISMA

- 606 references imported for screening
- 0 duplicates
- 606 studies screened as title and abstract
- 423 studies excluded
- 183 studies assessed for full-text eligibility
- 37 studies excluded
- 146 studies total

Literature Review Results

Investigations that only evaluated patients with *acute chest pain* (N=23) included:

- Four meta-analyses
- One systematic review
- 13 randomized controlled trials
- Three randomized controlled trial subanalyses
- Two prospective studies

From each publication, one or more rules reflecting results and conclusions about the utility of coronary CTA for patients with acute chest pain were extracted into an evidence table by a physician in a specialty relevant to the Appropriate Use Criteria (AUC), in collaboration with the clinical trial/statistics lead. The strength of the evidence was graded using Oxford Centre for Evidence-Based Medicine Levels of Evidence for each of the 23 publications:

- 15 studies with Oxford Grade 1 evidence

Johns Hopkins University School of Medicine
Appropriate Use Criteria
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- Eight studies with Oxford Grade 2 evidence

Evidence tables are found separately on the Johns Hopkins Medicine’s Appropriate Use Criteria [website](#).

APPROPRIATE USE CRITERIA

Title	Clinical scenario 1: Chest pain with high probability of acute coronary syndrome	Clinical scenario 2: Chest pain with intermediate probability of acute coronary syndrome in patient with no known coronary artery disease	Clinical scenario 3: Chest pain with intermediate probability of acute coronary syndrome in patient with known coronary artery disease	Clinical scenario 4: Chest pain with low probability of acute coronary syndrome	Clinical scenario 5: Chest pain with very low probability of acute coronary syndrome
Definition	One or more of the following: <ul style="list-style-type: none"> • Heart score > 6 • Acute ischemic EKG changes • Elevated troponin 	All of the following: <ul style="list-style-type: none"> • Heart score 4–6 OR significant clinical suspicion of acute coronary syndrome and/or coronary artery disease • Absence of acute ischemic EKG changes • Normal troponin • No known coronary artery disease 	All of the following: <ul style="list-style-type: none"> • Heart score 4–6 OR significant clinical suspicion of acute coronary syndrome and/or coronary artery disease • Absence of acute ischemic EKG changes • Normal troponin • Known coronary artery disease 	All of the following: <ul style="list-style-type: none"> • Heart score 1–3 • No elevated suspicion of coronary artery disease • Absence of acute ischemic EKG changes • Normal troponin 	All of the following: <ul style="list-style-type: none"> • Heart score 0 • No elevated suspicion of coronary artery disease • Absence of acute ischemic EKG changes • Normal troponin
AUC rules					

Johns Hopkins University School of Medicine
Appropriate Use Criteria
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Consistent with AUC	No cross-sectional imaging is consistent with AUC for this clinical scenario	<ul style="list-style-type: none"> • Coronary CTA • Nuclear medicine stress test 	Nuclear medicine stress test	Coronary CTA	No cross-sectional imaging is consistent with AUC for this clinical scenario
Allowable by AUC	No cross-sectional imaging is allowable with AUC for this clinical scenario				No cross-sectional imaging is allowable with AUC for this clinical scenario
Does not meet AUC	<ul style="list-style-type: none"> • Coronary CTA • Nuclear medicine stress test • Cardiac MRI • Coronary calcium score • Positron Emission Tomography (PET)/CT 	<ul style="list-style-type: none"> • Cardiac MRI • Coronary calcium score • PET/CT 	<ul style="list-style-type: none"> • Coronary CTA • Cardiac MRI • Coronary calcium score • PET/CT 	<ul style="list-style-type: none"> • Nuclear medicine stress test • Cardiac MRI • Coronary calcium score • PET/CT 	<ul style="list-style-type: none"> • Coronary CTA • Nuclear medicine stress test • Cardiac MRI • Coronary calcium score • PET/CT
Not applicable (no AUC)					

MULTIDISCIPLINARY TEAM

A multidisciplinary team with autonomous governance, decision-making and accountability for developing or modifying AUC was empaneled to develop AUC for patients with unstable chest pain. The multidisciplinary team developing these AUC includes seven or more practicing physician members, including more than one practicing physician with expertise in the clinical topic related to the AUC being developed or modified. Specifically, each team includes at least one practicing physician in the nonradiology specialty or specialties related to the AUC and at least one practicing physician in the radiology subspecialty related to the AUC. For acute chest pain, the relevant specialties and subspecialties are:

Johns Hopkins University School of Medicine
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- Cardiovascular radiology
- Cardiology
- Emergency medicine
- Internal medicine

The Johns Hopkins University School of Medicine requires that all practicing physicians participating in the development of AUC disclose any conflicts of interest using the International Community of Medical Journal Editors (ICMJE) form. This information is publicly available in a timely fashion upon request, for a period of not less than five years after the most recent published update of the relevant appropriate use criteria. The members of the CAD/unstable chest pain AUC development team are below, with their disclosure statement.

- Pamela Johnson, Body Imaging (CAP) Radiology, The Johns Hopkins Hospital
- Jeff Trost, Cardiology, Johns Hopkins Bayview Medical Center
- Armin Zadeh, Cardiology, The Johns Hopkins Hospital
- Stefan Zimmerman, Cardiovascular Radiology, The Johns Hopkins Hospital
- Arjun Chanmugam, Emergency Medicine, Johns Hopkins Bayview Medical Center and The Johns Hopkins Hospital
- Jonathan Hansen, Emergency Medicine, Johns Hopkins Bayview Medical Center
- Mary Masterson, Emergency Medicine, Johns Hopkins Bayview Medical Center
- Susan Peterson, Emergency Medicine, The Johns Hopkins Hospital
- Mustapha Saheed, Emergency Medicine, The Johns Hopkins Hospital
- Paul O'Rourke, General Internal Medicine, Johns Hopkins Bayview Medical Center
- Carrie Herzke, Hospital Medicine, The Johns Hopkins Hospital
- Brandyn Lau, Statistical Analysis/Clinical Trial Design

Disclosure: AUC developers may receive future royalties from licensure of AUC to CMS-approved clinical decision support mechanisms.

TRANSPARENT AND TIMELY UPDATING OF CRITERIA

A literature search for each AUC will be repeated and reviewed annually, and each AUC will be updated if sufficient strong evidence is identified.