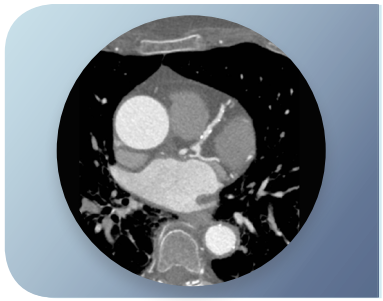


Intermountain Imaging Criteria:

Known or Suspected Coronary Artery Disease (CAD)

Through its Intermountain Imaging Criteria Project, Intermountain Healthcare has developed a suite of standardized care process models (CPMs) for the use of advanced imaging procedures in eight priority clinical areas. These evidence-based guidelines are intended to be widely implemented to improve patient safety, improve outcomes, and reduce unnecessary medical spending for the Medicare population and the U.S. health system overall.

Why Focus ON INTERMOUNTAIN IMAGING CRITERIA?

Advanced imaging procedures, including MRI, CT, PET, and nuclear medicine, facilitate rapid and accurate detection and/or diagnosis of disease. The volume of advanced imaging procedures prescribed to patients in the U.S. increased three- to four-fold from 1996–2010 as the technologies became widely available.[SMI] The inflating costs of advanced imaging outstripped that of any other medical service.[IGL, GAO] These inflating costs resulted in up to $20–30 billion in unnecessary advanced imaging spending each year.[NYDH]

- **High cost.** Although the spending growth in advanced imaging dropped off after the early 2000s, 2014 costs to Medicare Part B for advanced imaging exceeded $2.4 billion for common conditions alone.[LEV, CMS1]
- **Limited effectiveness.** Multiple studies suggest that up to a third of advanced imaging procedures fail to contribute to diagnosis or are clinically inappropriate.[NYDH]
- **Patient safety.** Advanced diagnostic imaging often exposes the patient to ionizing radiation and/or contrast media, posing additional medical risks that must be weighed against the potential benefits of the imaging procedure.
- **Overdiagnosis and overtreatment.** There is an unrecognized risk of overdiagnosis and subsequent overtreatment that carries associated risks (e.g., drug reactions or unnecessary surgical interventions) if advanced imaging is performed in patients with low pretest probability. The Intermountain Imaging Criteria approach seeks to avoid these risks.

GOALS AND MEASURES

Indicates an Intermountain measure

This CPM was developed by Intermountain clinical experts to outline appropriate use criteria (AUC) for advanced imaging for known or suspected coronary artery disease (CAD). These guidelines, together with those for other priority clinical areas, will improve the quality of care provided to patients by:

- Increasing adherence to evidence-based AUC for the use of advanced imaging
- Reducing imaging tests that do not conform to AUC or for which there are no guidelines
- Decreasing system-wide spending on unnecessary advanced imaging services
- Reducing the risk of harm from unwarranted radiation exposure
- Documenting the incidence of a significant positive on advanced imaging tests and aligning with downstream care

WHAT'S INSIDE?

Intermountain® Healthcare

OVERVIEW: INTERMOUNTAIN IMAGING CRITERIA AUC CONTENT

Intermountain Imaging Criteria Appropriate Use Criteria (AUC) support clinicians in providing evidence-based care to the patients they serve. Although appropriate use of Intermountain Imaging Criteria fulfills compliance requirements under PAMA, patients only fully benefit from their use as they are deployed within the framework of a locally driven quality improvement program. To learn more about Intermountain's process for developing and maintaining AUC, visit: https://intermountainhealthcare.org/services/imaging-services/intermountain-imaging-criteria.

The care process model approach

Designed as Care Process Models (CPMs), the Intermountain Imaging Criteria AUC content is a blueprint that logically guides the delivery of evidence-based care via an algorithmic visual presentation (see pages 5 through 8). Although these Intermountain Imaging Criteria CPMs specifically focus on the appropriate use of advanced imaging, they can be viewed as portions of broader CPMs that guide not only diagnostic but therapeutic interventions for a specific disease or condition.

Ideally, Intermountain Imaging Criteria CPMs are engaged early in the patient encounter and guide the various considerations that lead to the ultimate decision regarding the ordering of an imaging study.

Knowing that local factors will invariably impact decisions about selecting the most appropriate exam, Intermountain Imaging Criteria CPMs specify the generally preferred exam but also provide alternative choices that may be appropriate in certain clinical settings.

Relative imaging cost and radiation risk rankings

To further aid providers, each algorithm includes a ranking of relative costs and radiation risk for each advanced imaging test recommended. The cost scale is derived using global non-facility relative value units (RVUs) published by CMS as a surrogate for cost.[CMS2]

The radiation risk is derived from data published in 2010 by the Health Physics Society and in 2017 by the American Society of Nuclear Cardiology.[ACR, ASNC,HPS,]

Evidentiary review and ranking

Intermountain used the following two conceptual frameworks for evidentiary review of relevant literature:

1. The 2011 revision of the Oxford Centre for Evidence-Based Medicine (OCEBM) 2011 Levels of Evidence standard. This standard includes categorical leveling grades relevant to diagnostic studies and rates individual sources of evidence (published papers or other research data) on a five-point scale.[OCE]
2. The extensively used Fryback and Thornbury conceptual framework, which uses six levels for assessing the efficacy of diagnostic imaging.[FRY]

Each algorithmic presentation provides both rankings for the decision node (pairing of AUC and recommended/alternative tests).

Using the algorithms and checklists

Under "Care Pathways" on page 3, there is an annotated algorithmic sample for a typical clinical scenario found in this CPM. Under "Point-of-Order Checklist" on page 4, there is an annotated sample of a typical point-of-order checklist for an imaging procedure recommended within the above sample algorithm.

Abbreviations used in this CPM

AAA = abdominal aortic aneurysm
ACS = acute coronary syndrome
ASCVD = atherosclerotic cardiovascular disease
AF = atrial fibrillation
AV = atrioventricular
BPM = beats per minute
CABG = coronary artery bypass
CAC = coronary artery calcium
CAD = coronary artery disease
CCTA = cardiac CT anciography
CPG = clinical practice guideline
CPM = care process model
CT = computed tomography
cTnI = cardiac Troponin-I
ECG = electrocardiogram
ECHO = echocardiography
FDG = fluorodeoxyglucose
FFR = fractional flow reserve
GFR = glomerular filtration rate
HTN = hypertension
ICD = implantable cardioverter defibrillator
LBBB = left bundle branch block
LHC = left heart catheterization
LVEF = left ventricular ejection fraction
MRI = magnetic resonance imaging
mSv = milli-sievert
NSTEMI = non-ST-elevation myocardial infarction
PAD = peripheral artery disease
PCP = primary care provider
PET = positron emission tomography
PPM = permanent pacemaker
PVC = premature ventricular contraction
SPECT = single-photon emission computed tomography
STEMI = ST-elevation myocardial infarction
VT = ventricular tachycardia

Care pathways

See abbreviations on page 2.

For each clinical scenario (e.g., known or suspected coronary artery disease (CAD) in ambulatory or inpatient care setting), there is an algorithmic presentation of the care pathway context for the imaging decisions made. This pathway contains not only the appropriate use criteria (AUC) and evidence-based advanced imaging recommendations but also what constitutes significant positive imaging results and downstream care recommendations. Note the elements of this presentation below and key information provided in each test recommendation box as shown bottom center. There is also a legend at the bottom of each care pathway page.

The decision node box encompasses recommended advanced imaging based on the presence of evidence-based appropriate use criteria (AUC) or expert consensus (where evidence does not exist).

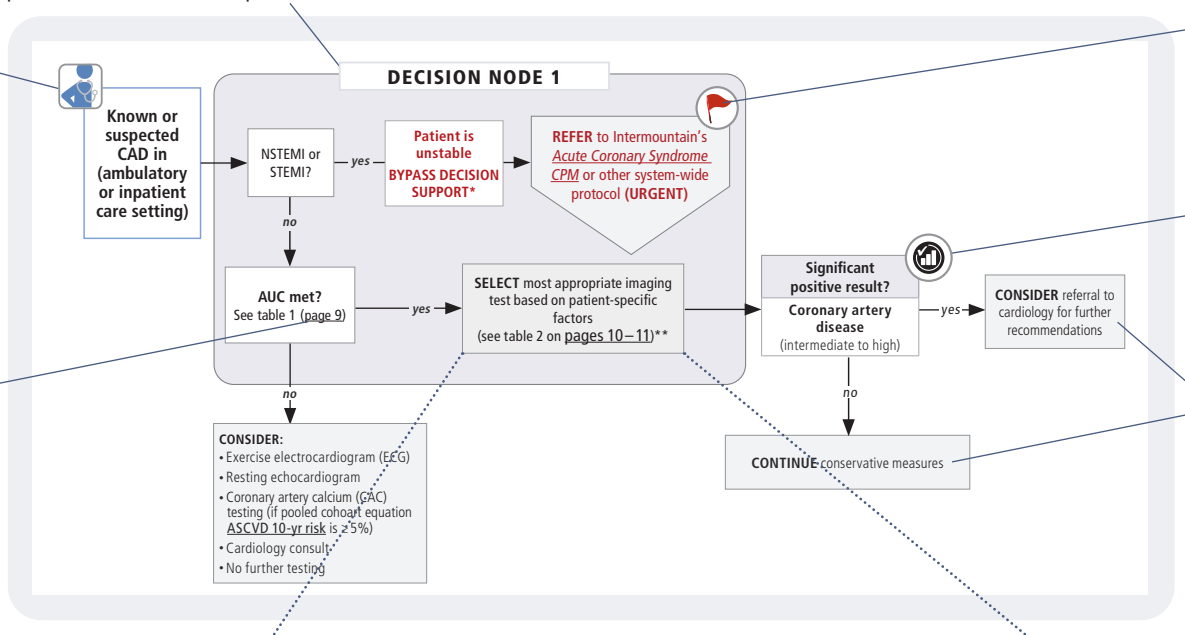
This symbol indicates a common clinical scenario.

This red flag signifies an urgent or emergency situation (sometimes this red flag indicates a scenario that may require bypassing the AUC logic).

This symbol indicates an Intermountain internal measure. Intermountain measures incidence of significant positive results on advanced imaging tests.

Underlining indicates a hyperlink to another document or to a page within the same document, as appropriate.

Downstream care recommendations are general guidelines and are subject to the discretion of individual healthcare providers and the providers' system protocols.



Cost rankings are indicated based on a range developed from the CMS Global Relative Value Units (RVUs) as follows:[CMS2]

$ = 0–5 RVUs
$$ = 5–10 RVUs
$$$ = 10–15 RVUs
$$$$ = 15 + RVUs

Characteristic	Cardiac molecular imaging	
	Cardiac PET	SPECT
Sensitivity Specificity	• 93 % • 92 %	• 82 % to 91 % • 70 % to 90 %
Radiation	**R3**	**R3-R4**
Cost	**$$$$**	**$$ ($$$ if multiple studies)**
Levels of evidence	1 II	1 II

Radiation risk rankings use the scale developed by the American College of Radiology.[ACE] This rating framework offers the following six levels for adult effective dose range risk:

R0 = 0 mSv
R1 = < 0.1 mSv
R2 = 0.1 – 1 mSv
R3 = 1 – 10 mSv
R4 = 10 – 30 mSv
R5 = 30 – 100 mSv

The Arabic number in the green box indicates an evidence ranking derived from the OCEBM scale.[OCE] For this scale, the **lower** the number, the stronger the evidence ranking.

The Roman numeral in the orange box indicates an evidence ranking derived from the Fryback & Thornbury scale.[FRY] For this scale, the **higher** the number, the stronger the evidence ranking.

Point-of-order checklist

See abbreviations on page 2.

Advanced cardiovascular imaging testing (e.g., MRI and CT) is determined by availability and the patient's condition. The checklist in this CPM compiles all of the appropriate use indications from each clinical scenario.

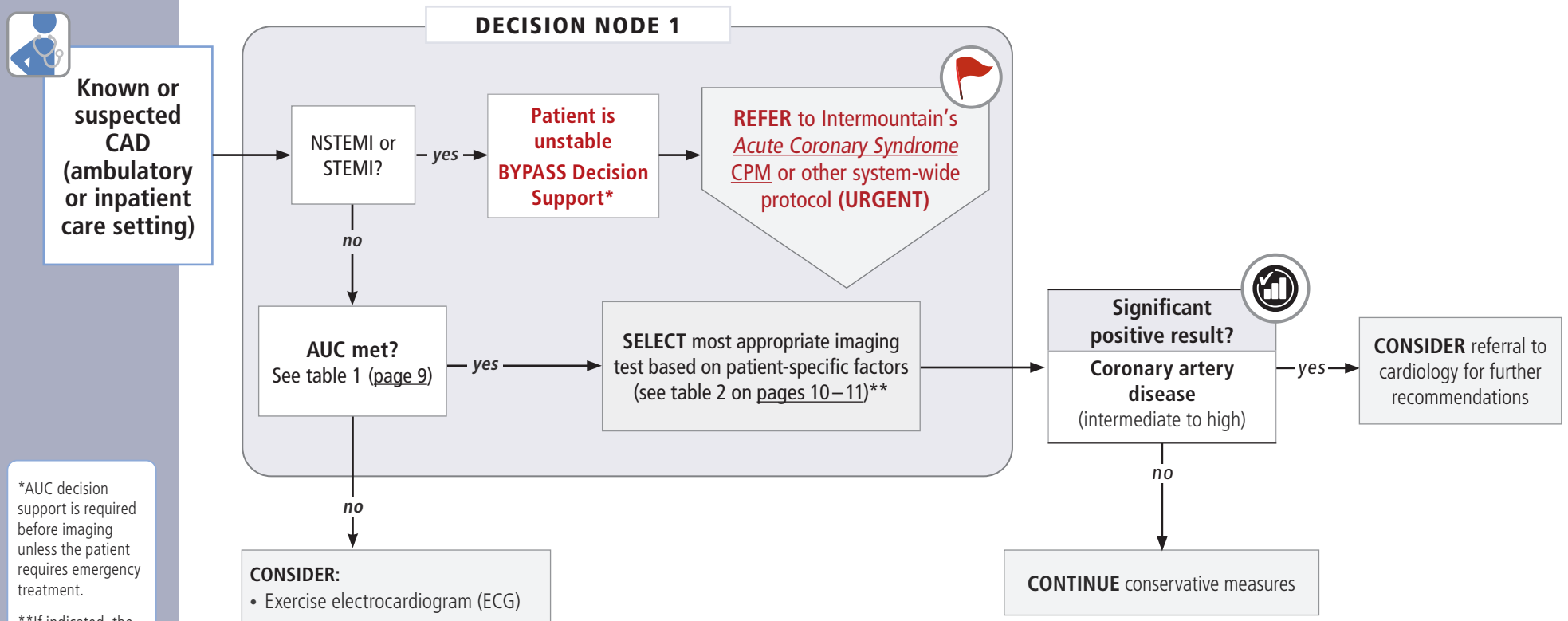
Table 1 on page 9 indicates appropriate use criteria in a checklist format, allowing the provider to select the appropriate scenario. The provider will then choose the appropriate test based on the criteria listed in **Table 2: Cardiac Imaging Considerations,** starting on page 10.

TABLE 1. Appropriate use indications for known or suspected CAD

Arrhythmia or abnormal ECG	Angina syndrome	Known heart disease	Preoperative risk stratification	Other
☐ Abnormal ECG, likely ischemia ☐ New-onset AF ☐ Frequent PVCs ☐ Non-sustained VT ☐ Exercise-induced VT ☐ Sustained VT, not due to a transient or reversible cause	☐ Angina syndrome, assess ischemia ☐ Angina syndrome with diabetes, CAD, AAA, or PAD ☐ Angina syndrome with 3 or more coronary heart disease risk factors* ☐ Angina equivalent such as exertional dyspnea, jaw pain, PVCs, or arm pain	☐ Known heart CAD with new or worsening angina equivalents ☐ New-onset heart failure ☐ Hemodynamic valve disease ☐ CAC >400, PAD, or AAA ☐ Coronary stenosis (LHC, CTA) of uncertain significance ☐ Prior incomplete coronary occlusion revascularization where additional revascularization is feasible ☐ Viability assessment in patients who are eligible for coronary revascularization	☐ Planned vascular surgery with poor functional capacity, heart failure, hypertension/kidney disease ☐ Intermediate to high-risk surgery with poor functional capacity, heart failure, hypertension/kidney disease ☐ Pre-non-cardiac transplant evaluation (e.g., liver, kidney, bone marrow transplant, etc.)	☐ Unexplained elevated troponin and concern for impending infarctions, without ACS ☐ Previous equivocal, borderline cardiac stress test result, when CAD remains a concern ☐ Syncope with coronary heart disease risk equivalent or moderate to high coronary heart disease event risk

CORONARY ARTERY DISEASE (CAD) CARE PATHWAY ALGORITHMS

See abbreviations on page 2.



*AUC decision support is required before imaging unless the patient requires emergency treatment.

**If indicated, the imaging test should be customized for the patient based on the information in this CPM.

***If unable to calculate ASCVD risk score, then AUC is not applicable.

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **$** (0–5 RVUs) **R3** (1–10 mSv) **$$** (5–10 RVUs) **R4** (10–30 mSv) **$$$** (10–15 RVUs) **$$$$** (15+ RVUs) See page 2–3 for explanation.

KEY EVIDENCE: DECISION NODE 1

Cremer P, Hachamovitch R, Tamarappoo B. Clinical decision making with myocardial perfusion imaging in patients with known or suspected coronary artery disease. *Semin Nucl Med.* 2014;44(4):320-329.

Di Leo G, Fisci E, Secchi F, et al. Diagnostic accuracy of magnetic resonance angiography for detection of coronary artery disease: A systematic review and meta-analysis. *Eur Radiol.* 2016;26(10):3706-3718.

Hecht HS. Coronary artery calcium scanning: Past, present, and future. *JACC Cardiovasc Imaging.* 2015 May;8(5):579-596.

Li M, Zhou T, Yang LF, Peng ZH, Ding J, Sun G. Diagnostic accuracy of myocardial magnetic resonance perfusion to diagnose ischemic stenosis with fractional flow reserve as reference: Systematic review and meta-analysis. *JACC Cardiovasc Imaging.* 2014;7(11):1098-1105.

Nasis A, Meredith IT, Cameron JD, Seneviratne SK. Coronary computed tomography angiography for the assessment of chest pain: Current status and future directions. *Int J Cardiovasc Imaging.* 2015;31(Suppl 2):125-143.

Zhou T, Yang LF, Zhai JL, et al. SPECT myocardial perfusion versus fractional flow reserve for evaluation of functional ischemia: A meta analysis. *Eur J Radiol.* 2014;83(6):951-956.

(For a list of references for all decision nodes, see the complete bibliography on page 14.)

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5–10 RVUs) **$$$** (10–15 RVUs) **$$$$ (15+ RVUs)

See abbreviations on page 2.

Known or suspected CAD (ED or urgent care setting)

DECISION NODE 2

STEMI? — *yes* → **Patient is unstable BYPASS Decision Support***

no

Cardiac troponin-I ≥ 2? — *yes* → NSTEMI

no

Short-term cardiovascular risk **

LOW risk** | MEDIUM risk** | HIGH risk**

Evidence of acute myocardial injury?† — *yes* → **CONSULT** Cardiology **CONSIDER ADMIT**

no

Review table 1 (page 9). AUC met? — *yes* → **SELECT** most appropriate imaging test based on patient-specific factors (see table 2 on pages 10–11)***

no

CONTINUE conservative measures
CONSIDER referral to PCP or cardiology for additional testing

Significant positive result?
Coronary artery disease (intermediate to high)

yes → **CONSIDER** referral to cardiology for further recommendations

no

CONTINUE conservative measures
CONSIDER referral to PCP or cardiology for additional testing

INITIATE site-specific STEMI protocol

CONSULT Cardiology **ADMIT**

MANAGE per *Acute Coronary Syndrome* CPM or system-approved CPG

*AUC decision support is required before imaging unless the patient requires emergency treatment.

**Determine risk using validated risk stratification algorithm such as the HEART risk score www.heartscore.nl/score/

***If indicated, the imaging test should be customized for the patient based on the information in this CPM.

†Determine if evidence of acute myocardial injury. Consider using
Low risk:
Table 3 on page 12
Intermediate risk:
Table 4 on page 12

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5–10 RVUs) **$$$** (10–15 RVUs) **$$$$ (15+ RVUs)

KEY EVIDENCE: DECISION NODE 2

Cremer P, Hachamovitch R, Tamarappoo B. Clinical decision making with myocardial perfusion imaging in patients with known or suspected coronary artery disease. *Semin Nucl Med.* 2014;44(4):320-329.

Di Leo G, Fisci E, Secchi F, et al. Diagnostic accuracy of magnetic resonance angiography for detection of coronary artery disease: A systematic review and meta-analysis. *Eur Radiol.* 2016;26(10):3706-3718.

Hecht HS. Coronary artery calcium scanning: Past, present, and future. *JACC Cardiovasc Imaging.* 2015;8(5):579-596.

Li M, Zhou T, Yang LF, Peng ZH, Ding J, Sun G. Diagnostic accuracy of myocardial magnetic resonance perfusion to diagnose ischemic stenosis with fractional flow reserve as reference: Systematic review and meta-analysis. *JACC Cardiovasc Imaging.* 2014;7(11):1098-1105.

Nasis A, Meredith IT, Cameron JD, Seneviratne SK. Coronary computed tomography angiography for the assessment of chest pain: Current status and future directions. *Int J Cardiovasc Imaging.* 2015;31(Suppl 2):125-143.

Wolk M J, et al. ACCF/AHA/ASE/ASNC/HFSA/HRS/SCAI/SCCT/SCMR/STS 2013 multimodality appropriate use criteria for the detection and risk assessment of stable ischemic heart disease: A report of the American College of Cardiology foundation appropriate use criteria task force, American Heart Association, American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Failure Society of America, Heart Rhythm Society, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Computed Tomography, Society for Cardiovascular Magnetic Resonance, and Society of Thoracic Surgeons. *J Am Coll Cardiol.* 2014;63(4):380-406.

Zhou T, Yang LF, Zhai JL, et al. SPECT myocardial perfusion versus fractional flow reserve for evaluation of functional ischemia: A meta analysis. *Eur J Radiol.* 2014;83(6):951-956.

(For a list of references for all decision nodes, see the complete bibliography on page 14.)

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5–10 RVUs) **$$$** (10–15 RVUs) **$$$$ (15+ RVUs)

POINT-OF-ORDER CHECKLIST

See abbreviations on page 2.

This checklist indicates appropriate use criteria. The provider should select the appropriate scenario and then choose the appropriate test based on the criteria listed in **Table 2: Cardiac Imaging Considerations** starting on page 10.

TABLE 1. Appropriate use indications for known or suspected CAD

Arrhythmia or abnormal ECG	Angina syndrome	Known heart disease	Preoperative risk stratification	Other
☐ Abnormal ECG, likely ischemia ☐ New-onset AF ☐ Frequent PVCs ☐ Non-sustained VT ☐ Exercise-induced VT ☐ Sustained VT, not due to a transient or reversible cause	☐ Angina syndrome, assess ischemia ☐ Angina syndrome with diabetes, CAD, AAA, or PAD ☐ Angina syndrome with 3 or more coronary heart disease risk factors* ☐ Angina equivalent such as exertional dyspnea, jaw pain, PVCs, or arm pain	☐ Known heart CAD with new or worsening angina equivalents ☐ New-onset heart failure ☐ Hemodynamic valve disease ☐ CAC > 400, PAD, or AAA ☐ Coronary stenosis (LHC, CTA) of uncertain significance ☐ Prior incomplete coronary occlusion revascularization where additional revascularization is feasible ☐ Viability assessment in patients who are eligible for coronary revascularization	☐ Planned vascular surgery with poor functional capacity, heart failure, hypertension / kidney disease ☐ Intermediate to high-risk surgery with poor functional capacity, heart failure, hypertension / kidney disease ☐ Pre-non-cardiac transplant evaluation (e.g., liver, kidney, bone marrow transplant, etc.)	☐ Unexplained elevated troponin and concern for impending infarctions, without ACS ☐ Previous equivocal, borderline cardiac stress test result, when CAD remains a concern ☐ Syncope with coronary heart disease risk equivalent or moderate to high coronary heart disease event risk

* Coronary Heart Disease (CHD) Risk Factors (moderate = 3 risk factors; high ≥ 4 risk factors):
  - Age (men > 45 years, women > 55 years)
  - Cigarette smoking and / or hypertension (BP > 140 / 90 mmHg or antihypertension medications)
  - Impaired fasting glucose (101 – 125 mg / dL)
  - Family history of premature CHD (CHD in male first-degree relative < 55 years, female first-degree relative < 65 years)

TABLE 2. Cardiac imaging considerations

See abbreviations on page 2.

Characteristic	Cardiac molecular imaging		Computed tomography (CT) imaging	
	Cardiac PET	**SPECT**	**Coronary CT angiography**	**Coronary artery calcium (CAC) score**
Sensitivity Specificity	• 93 % • 92 %	• 82–91 % • 70–90 %	• 93–97 % • 80–90 %	• 85–98 % • 45–75 %
Radiation	**R3**	**R3–R4**	**R3**	**R3**
Cost	**$$$$**	**$$ ($$$ if multiple studies)**	**$$**	**$**
Levels of evidence	1 II	1 II	1 V	1 V
When to consider	• Availability • Obese patient • Abnormal ECG, including LBBB • PPM/ICD patients • Patient with poor functional capacity • Pre-renal transplant assessment • Cardiac transplant vasculopathy assessment • Need for viability assessment (FDG)	• Availability • Abnormal ECG (pharmacologic) • PPM/ICD patients (pharmacologic) • Need for functional capacity assessment (treadmill SPECT)	• Availability • Lower pretest likelihood of disease • Patient with poor functional capacity • Stent and CABG patency assessment • Need for concomitant thoracic tomographic imaging (i.e., aorta, relationship of structures to sternum, etc.)	Further risk stratification of asymptomatic patients
Value	• Compared to SPECT, PET offers: – Higher spatial and temporal resolution – Better attenuation correction – Quantification of myocardial blood flow – Shorter testing time • Concomitant CAC and/or CCTA may be available to enhance diagnostic accuracy	• Compared to PET, SPECT is: – Widely available – Offers ability to perform functional capacity assessment (treadmill SPECT) • Concomitant CAC and/or CCTA may be available to enhance diagnostic accuracy	• High negative predictive value (up to 99 %) • Concomitant stress perfusion and/or FFR may be available to enhance diagnostic accuracy (limited availability)	• Prognostic value • Appropriate for asymptomatic patients at risk for ASCVD (10-year risk ≥ 5 %, + family history)
Limitations	• Limited availability in some regions • No functional capacity assessment (pharmacologic stress) • Unable to perform in patients with epilepsy and/or high AV block	• Decreased sensitivity in ventricular pacing and LBBB with exercise SPECT • Pharmacologic preferred • Unable to perform pharmacologic SPECT in patients with epilepsy and/or high-AV block • Decreased sensitivity in obese patients or patients with large amount of breast tissue	• Heart rate (ideally < 90 BPM) • Use of iodinated contrast • Risk of contrast nephropathy • Decreased sensitivity in patients with significant coronary artery calcifications • No functional capacity assessment	• No luminal assessment beyond presence of CAC • Limited role in symptomatic patients

LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5–10 RVUs) **$$$** (10–15 RVUs) **$$$$ (15+ RVUs)

TABLE 2. Cardiac imaging considerations, continued

See abbreviations on page 2.

Characteristic	Magnetic resonance imaging (MRI)	Echocardiography (alternative)		Electrocardiogram (alternative)
	Stress cardiac MRI	**Treadmill echocardiography**	**Dobutamine echocardiography**	
Sensitivity Specificity	• 83–91 % • 81–86 %	• 70–85 % • 77–89 %	• 85–90 % • 79–90 %	• 61–68 % • 70–77 %
Radiation	**R0**	N/A	N/A	N/A
Cost	**$$$**	**$**	**$**	**$**
Levels of evidence	1 II	NA* NA*	NA* NA*	NA* NA*
When to consider	• Availability • Patient has poor functional capacity • Need for viability/tissue characterization • Need for cardiac anatomic assessment • Need for cardiac function quantification	• Able to exercise • Need for cardiac function • Need for valvular assessment	• Unable to exercise • Need for cardiac function • Need for valvular assessment, i.e., paradoxical low flow, low-gradient aortic stenosis (low-dose protocol)	• Normal baseline ECG in patient who can exercise and achieve an adequate HR and cardiac workload • Need for functional capacity assessment • Assessment of arrhythmias, hemodynamic issues, or symptoms related to heart rate or exertion
Value	• Concomitant viability/tissue characterization • Gold standard for LVEF assessment • Concomitant valvular assessment • No radiation	• Widely available • Offers functional capacity assessment (prognostic value) • Concomitant valvular assessment • No radiation • Provides hemodynamic assessment to exertion	• Concomitant valvular assessment • No radiation • Viability assessment	• Widely available • Functional capacity assessment that provides prognostic value • Less technically demanding
Limitations	• Availability • Claustrophobia • Need to hold breath • Length of study • No functional assessment (limited availability of exercise cardiac MRI) • Use of gadolinium-based contrast (need GFR > 30) • Limited assessment in PPM/ICD patients	• Technically challenging • Limited assessment in LBBB patients • Limited assessment in PPM/ICD patients	• Technically challenging • Non-physiologic cardiac assessment • Contraindicated in sustained or frequent ventricular or atrial arrhythmias • Hypertrophic cardiomyopathy with left ventricular outflow obstruction • Severe hypertension	• Not appropriate if unable to sufficiently exercise • Not appropriate if resting ECG changes (LBBB, ST-T wave changes, paced-rhythm, pre-excitation changes) • Not appropriate in unstable patients, severe valvular stenosis, uncontrolled heart failure, uncontrolled arrhythmias • Decreased sensitivity in females • Does not provide information on cardiac structure and function • Limited localization of ischemia • Decreased sensitivity/specificity compared to stress-imaging testing

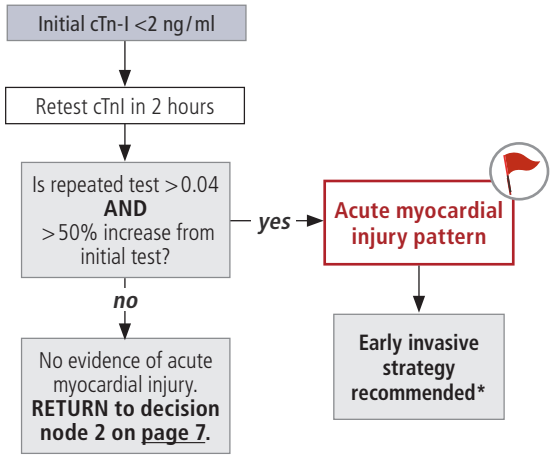
LEGEND

Clinical Scenario | Urgent or Emergency Situation | 2 OCEBM Level of Evidence | II Fryback & Thornbury Level of Evidence | Intermountain Measure

R0 (0 mSv) **R3** (1–10 mSv) **R4** (10–30 mSv) See page 2–3 for explanation.
$** (0–5 RVUs) **$$** (5–10 RVUs) **$$$** (10–15 RVUs) **$$$$ (15+ RVUs)

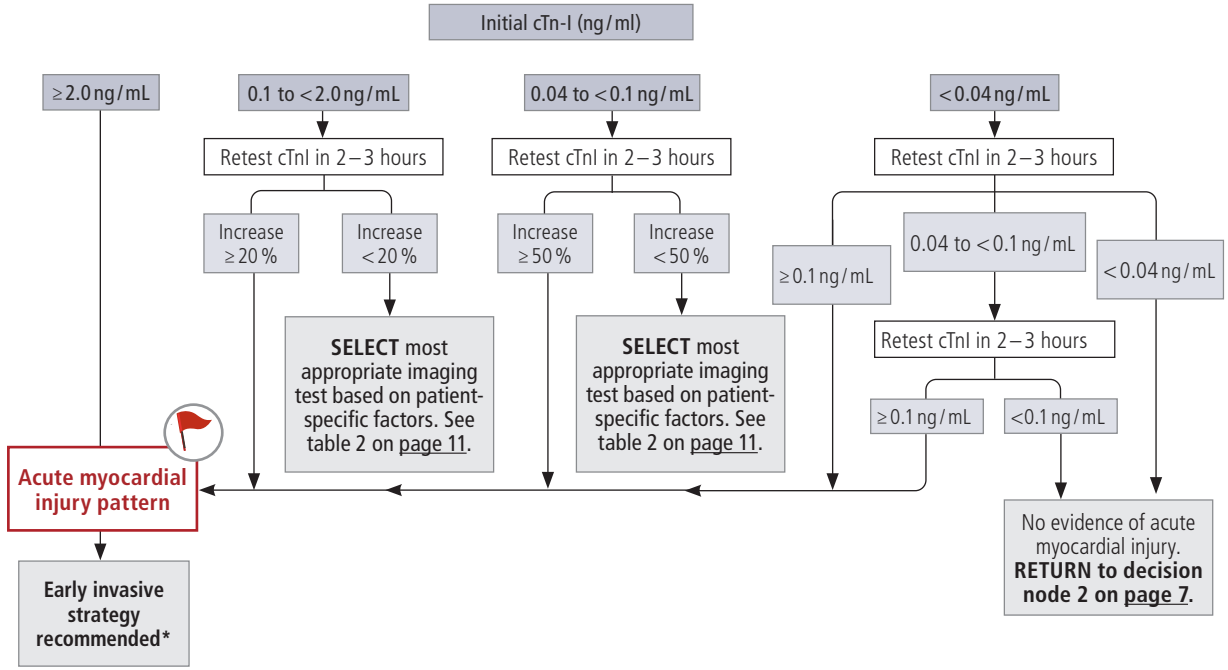
See abbreviations on page 2.

TABLE 3. Assessment of acute myocardial injury: Delta troponin testing for patients at low-risk



***Admit to hospital:** Begin aspirin and enoxaparin therapy. **CONSIDER**: Beta blocker, tirofiban (if ongoing chest pain), left heart catheterization.

TABLE 4. Assessment of acute myocardial injury: Delta troponin testing for patients at medium risk



***Admit to hospital:** Begin aspirin and enoxaparin therapy. **CONSIDER**: Beta blocker, tirofiban (if ongoing chest pain), left heart catheterization.

RESOURCES

Intermountain provides educational materials designed to support providers in their efforts to care for, educate, and engage patients and their families.

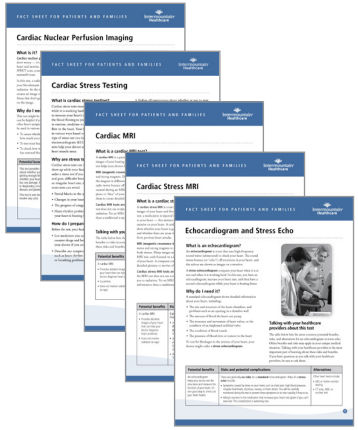
Intermountain's patient education materials complement and reinforce clinical team interventions by providing a means for patients to reflect and learn in another mode and at their own pace. See https://intermountainhealthcare.org/health-information/health-library/patient-handouts/.

Intermountain's Care Process Models (CPMs) outline evidence-based guidelines for patient care. In addition to the suite of Intermountain Imaging Criteria CPMs, Intermountain provides topical CPMs that have been developed by expert clinical teams. They can be accessed by navigating to intermountainphysician.org and selecting **Care Process Models** in the **Tools and Resources** drop-down menu.

To access Intermountain's Imaging Criteria CPMs and supporting materials, visit: https://intermountainhealthcare.org/services/imaging-services/intermountain-imaging-criteria/.

Patient Fact Sheets:

- *Cardiac Nuclear Perfusion Imaging (English) / (Spanish)*
- *Cardiac Stress Testing (English) / (Spanish)*
- *Cardiac MRI (English) / (Spanish)*
- *Cardiac Stress MRI (English) / (Spanish)*

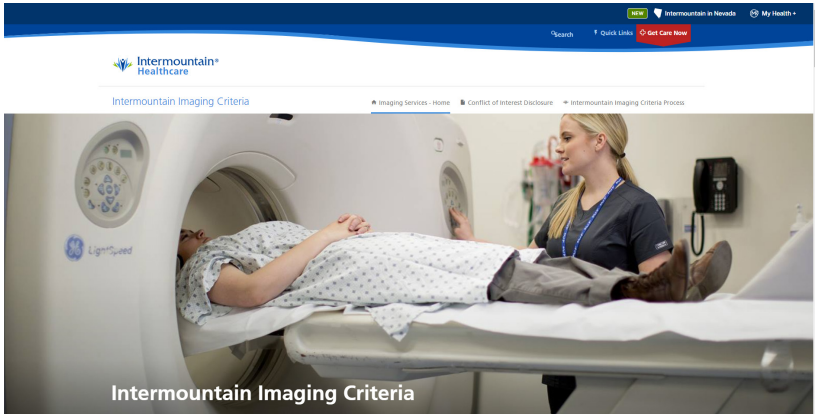


Patient Fact sheets:

- *Coronary CT Angiogram (English) / (Spanish)*
- *Coronary Calcium CT Scan (English) / (Spanish)*
- *Intravenous (IV) Contrast Material (English) / (Spanish)*
- *Electrocardiogram (ECG or EKG) (English) / (Spanish)*
- *Echocardiogram and Stress Echo (English) / (Spanish)*

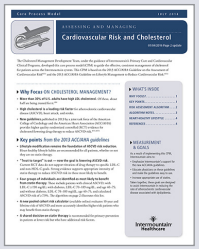
Patient education:

- *Heart Care Handbook (English) / (Spanish)*



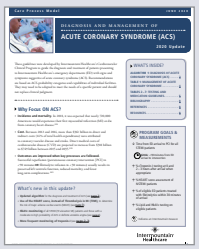
Related Care Process Models (CPMs):

Management of High Blood Pressure



Cardiovascular Risk and Cholesterol

Atrial Fibrillation



Acute Coronary Syndrome

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OCE OCEBM Levels of Evidence Working Group; Oxford Centre for Evidence-Based Medicine. The Oxford 2011 Levels of Evidence. http://www.cebm.net/index.aspx?o=5653. Accessed July 31, 2017.

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This CPM presents a model of best care based on the best available scientific evidence at the time of publication. It is not a prescription for every physician or every patient, nor does it replace clinical judgment. All statements, protocols, and recommendations herein are viewed as transitory and iterative. Although physicians are encouraged to follow the CPM to help focus on and measure quality, deviations are a means for discovering improvements in patient care and expanding the knowledge base.

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