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. The inflating costs of advanced imaging outstripped that of any other medical service. These inflating costs resulted in up to $20–30 billion in unnecessary advanced imaging spending each year.

- **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.
- **Limited effectiveness.** Multiple studies suggest that up to a third of advanced imaging procedures fail to contribute to diagnosis or are clinically inappropriate.
- **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**

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?**

**OVERVIEW: INTERMOUNTAIN IMAGING CRITERIA AUC CONTENT**

**CORONARY ARTERY DISEASE (CAD)**

- **KAPROXYRATHWAYS: ALGORITHMS**
  - Known or suspected CAD (ambulatory or inpatient care setting)
  - Known or suspected CAD (ED or urgent care setting)

**POINT-OF-ORDER CHECKLIST**

**TABLE 2: CARDIAC IMAGING CONSIDERATIONS**

**TABLE 3: ASSESSMENT OF ACUTE MYOCARDIAL INJURY: DELTA TROPOSIN TESTING FOR PATIENTS WITH LOW RISK**

**TABLE 4: ASSESSMENT OF ACUTE MYOCARDIAL INJURY: DELTA TROPOSIN TESTING FOR PATIENTS WITH MEDIUM RISK**

**RESOURCES**

**BIBLIOGRAPHY**

**REFERENCES**
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. 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. The cost scale is derived using global non-facility relative value units (RVUs) published by CMS as a surrogate for cost.

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.

2. The extensively used Fryback and Thornbury conceptual framework, which uses six levels for assessing the efficacy of diagnostic imaging. 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
- CAB = coronary artery calcium
- CAD = coronary artery disease
- CCTA = cardiac CT angiography
- CPG = clinical practice guideline
- CPM = care process model
- CT = computed tomography
- cTnl = 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
Liver Transplantation

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).

Cost rankings are indicated based on a range developed from the CMS Global Relative Value Units (RVUs) as follows: $ = 0–5 RVUs, $$ = 5–10 RVUs, $$$ = 10–15 RVUs, $$$$ = 15+ RVUs.

The Arabic number in the green box indicates an evidence ranking derived from the OCEBM scale. 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. For this scale, the higher the number, the stronger the evidence ranking.

Radiation risk rankings use the scale developed by the American College of Radiology. 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.

Care pathways

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.
**Point-of-order checklist**

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**

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

**DECISION NODE 1**

- **Known or suspected CAD** (ambulatory or inpatient care setting)

- **NSTEMI or STEMI?**
  - yes → **Patient is unstable**
    - BYPASS Decision Support*
    - **REFER to Intermountain’s Acute Coronary Syndrome CPM or other system-wide protocol (URGENT)**
  - no → **AUC met?**
    - yes → **SELECT most appropriate imaging test based on patient-specific factors** (see table 2 on pages 10–11)**
    - no → **CONSIDER:***
      - Exercise electrocardiogram (ECG)
      - Resting echocardiogram
      - Coronary artery calcium (CAC) testing (if pooled cohort equation **ASCVD 10-year risk** is ≥ 5 %)**
      - Cardiology consult
      - No further testing

- **AUC met?**
  - yes → **CONSIDER:***
  - no → **CONTINUE** conservative measures

- **SIGNIFICANT positive result?**
  - yes → **Coronary artery disease** (intermediate to high)
  - no → **CONSIDER** referral to cardiology for further recommendations

---

**LEGEND**

- **Clinical Scenario**
- **Urgent or Emergency Situation**
- **OCEBM Level of Evidence**
- **Fryback & Thornbury Level of Evidence**
- **Intermountain Measure**
- **RO (0 mSv)**
- **R 3 (1–10 mSv)**
- **R 4 (10–30 mSv)**
- **$ (0–5 RVUs)**
- **$ $ (5–10 RVUs)**
- **$ $$ (10–15 RVUs)**
- **$ $$$ (15+ RVUs)**

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**KEY EVIDENCE: DECISION NODE 1**


(For a list of references for all decision nodes, see the complete bibliography on page 14.)
**Known or suspected CAD (ED or urgent care setting)**

**DECISION NODE 2**

- **STEMI?**
  - yes: **INITIATE site-specific STEMI protocol**
  - no:
    - **Cardiac troponin-I ≥ 2?**
      - yes: **CONSULT Cardiology ADMIT**
      - no:
        - **Short-term cardiovascular risk **
          - **LOW risk**
            - **Evidence of acute myocardial injury?**
              - yes: **CONSULT Cardiology CONSIDER ADMIT**
              - no: **CONTINUE conservative measures CONSIDER referral to PCP or cardiology for additional testing**
            - **MEDIUM risk**
              - **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**
              - **BYPASS Decision Support***
              - **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**
            - **HIGH risk**
              - **Evidence of acute myocardial injury?**
                - yes: **CONSULT Cardiology CONSIDER ADMIT**
                - no: **CONTINUE conservative measures CONSIDER referral to PCP or cardiology for additional testing**
          - **BYPASS Decision Support***

**NOTES**

- **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/](http://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**
- **Level of Evidence**
- **Clinical Decision Support**
- **Fryback & Thornbury Level of Evidence**
- **Intermountain Measure**
- **RO (0 mSv)**
- **R3 (1–10 mSv)**
- **R4 (10–30 mSv)**

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(For a list of references for all decision nodes, see the complete bibliography on page 14.)
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<tr>
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<td>□ New-onset heart failure</td>
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</tr>
<tr>
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<td>□ Angina syndrome with 3 or more coronary heart disease risk factors*</td>
<td>□ Hemodynamic valve disease</td>
<td>□ Pre-non-cardiac transplant evaluation (e.g., liver, kidney, bone marrow transplant, etc.)</td>
<td>□ Syncope with coronary heart disease risk equivalent or moderate to high coronary heart disease event risk</td>
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<td>□ Viability assessment in patients who are eligible for coronary revascularization</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Sustained VT, not due to a transient or reversible cause</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 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

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Cardiac molecular imaging</th>
<th>Computed tomography (CT) imaging</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cardiac PET</td>
<td>SPECT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>• 93 %</td>
<td>• 82 – 91 %</td>
</tr>
<tr>
<td>Specificity</td>
<td>• 92 %</td>
<td>• 70 – 90 %</td>
</tr>
<tr>
<td>Radiation</td>
<td>R3</td>
<td>R3 – R4</td>
</tr>
<tr>
<td>Cost</td>
<td>$$$$</td>
<td>$ ($$$$ if multiple studies)</td>
</tr>
<tr>
<td>Levels of evidence</td>
<td>1</td>
<td>II</td>
</tr>
</tbody>
</table>

#### When to consider

- **Cardiac PET**
  - 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)

- **SPECT**
  - Availability
  - Abnormal ECG (pharmacologic)
  - PPM / ICD patients (pharmacologic)
  - Need for functional capacity assessment (treadmill SPECT)

- **Coronary CT angiography**
  - 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.)

- **Coronary artery calcium (CAC) score**
  - Further risk stratification of asymptomatic patients

#### Value

- **Cardiac PET**
  - Compared to PET, SPECT 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

- **SPECT**
  - 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

- **Coronary CT angiography**
  - High negative predictive value (up to 99 %)
  - Concomitant stress perfusion and/or FFR may be available to enhance diagnostic accuracy (limited availability)

- **Coronary artery calcium (CAC) score**
  - Prognostic value
  - Appropriate for asymptomatic patients at risk for ASCVD (10-year risk ≥ 5 %, + family history)

#### Limitations

- **Cardiac PET**
  - Limited availability in some regions
  - No functional capacity assessment (pharmacologic stress)
  - Unable to perform in patients with epilepsy and/or high AV block

- **SPECT**
  - 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

- **Coronary CT angiography**
  - 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

- **Coronary artery calcium (CAC) score**
  - No luminal assessment beyond presence of CAC
  - Limited role in symptomatic patients

---

**LEGEND**

- **Clinical Scenario**
- **Urgent or Emergency Situation**
- **OCEBM Level of Evidence**
- **Fryback & Thornbury Level of Evidence**
- **Intermountain Measure**
- **RO (0 mSv) $ (0 – 5 RVUs)**
- **R3 (1 – 10 mSv) $ (5 – 10 RVUs)**
- **R4 (10 – 30 mSv) See page 2 – 3 for explanation. $ $ $ (15+ RVUs)**
**TABLE 2. Cardiac imaging considerations, continued**

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

**LEGEND**

- **Clinical Scenario**
- **Urgent or Emergency Situation**
- **OCEBM Level of Evidence**
- **Fryback & Thornbury Level of Evidence**
- **Intermountain Measure**
- **RO (0 mSv)**
- **R 3 (1 – 10 mSv)**
- **R 4 (10 – 30 mSv)**
- **$ (0 – 5 RVUs)**
- **$ $ $ (5 – 10 RVUs)**
- **$ $ $ $ (10 – 15 RVUs)**
- **$ $ $ $ $ (15+ RVUs)**
**TABLE 3. Assessment of acute myocardial injury: Delta troponin testing for patients at low-risk**

<table>
<thead>
<tr>
<th>Initial cTn-I (ng/ml)</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤0.04 ng/mL</td>
<td>No evidence of acute myocardial injury. RETURN to decision node 2 on page 7.</td>
</tr>
<tr>
<td>&gt;0.04 to &lt;0.1 ng/mL</td>
<td>retest cTnI in 2–3 hours</td>
</tr>
<tr>
<td>≥0.1 ng/mL</td>
<td>≥20% increase</td>
</tr>
<tr>
<td></td>
<td>&lt;20% increase</td>
</tr>
<tr>
<td></td>
<td>≥50% increase</td>
</tr>
<tr>
<td></td>
<td>&lt;50% increase</td>
</tr>
</tbody>
</table>

*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**

<table>
<thead>
<tr>
<th>Initial cTn-I (ng/ml)</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤0.04 ng/mL</td>
<td>No evidence of acute myocardial injury. RETURN to decision node 2 on page 7.</td>
</tr>
<tr>
<td>&gt;0.04 to &lt;0.1 ng/mL</td>
<td>retest cTnI in 2–3 hours</td>
</tr>
<tr>
<td>≥0.1 ng/mL</td>
<td>≥20% increase</td>
</tr>
<tr>
<td></td>
<td>&lt;20% increase</td>
</tr>
<tr>
<td></td>
<td>≥50% increase</td>
</tr>
<tr>
<td></td>
<td>&lt;50% increase</td>
</tr>
</tbody>
</table>

*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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