Clinical Validation Guidelines

Myocardial Ischemia and Infarction Guideline

Definition: a range of clinical presentations caused by inadequate blood flow to the heart. The reduced blood flow can result from the presence of a coronary artery thrombus (e.g. acute coronary syndromes (ACS)) or a supply/demand mismatch (e.g. Type II MI). ACS can be further differentiated into ST- elevation myocardial infarction (STEMI), non-ST-elevation myocardial infarction (NSTEMI), or unstable angina.

Diagnostic Criteria [1,2]: To clinically validate the following diagnoses the listed criteria must be met AND the diagnosis must be documented by a physician in the medical records.

(R79.89) Troponinemia, troponin leak or troponinitis: (ALL of the following from Criteria #1- Criteria #3 is needed to make the diagnosis):

1) Elevated cardiac troponin levels
2) No symptoms of myocardial ischemia (chest pain, shortness of breath)
3) No evidence of stenosis in the coronary arteries

(I24.8) Demand Ischemia (ALL of the following from Criteria #1- Criteria #4 is needed to make the diagnosis):

1) Symptoms of myocardial ischemia (chest pain, shortness of breath).
2) Documentation of a condition or suspected condition causing mismatch between myocardial oxygen demand and blood supply to the heart muscle (e.g. infection, anemia, tachycardia).
3) There is no troponin level above the 99th percentile.
4) No evidence of stenosis in the coronary arteries.

(I20.9) Angina (ONE of the following a, b, or c from Criteria #1 + ALL of the following from Criteria #2 -Criteria #4 is needed to make the diagnosis):

1) Symptoms of chest pain or pressure
    a. **(I20.0)** Unstable angina: occurs at rest.
    b. **(I20.89)** Stable angina: occurs with exertion.
    c. **(I20.2)** Refractory angina pectoris: Frequent episodes of anginal that are uncontrolled by drug therapy and occur in the presence of coronary artery disease, which contraindicates percutaneous coronary intervention or CABG surgery.
2) There is no troponin level above the 99th percentile.
3) Evidence of stenosis in the coronary arteries (documented in physician notes or imaging).
4) Can be relieved with rest or nitrates.

(I5A) Non-ischemic myocardial injury (ALL of the following from Criteria #1 - Criteria #3 is needed to make the diagnosis):[1,3]

1) Elevated troponins with at least one value above the 99th percentile.
    a. The myocardial injury can be acute or chronic (troponins may be acutely or chronically elevated)
2) No evidence of acute myocardial ischemia by EKG or imaging findings

3) Documentation that the myocardial injury is not due to CAD, but due to non-ischemic causes (e.g. heart failure, myocarditis, CKD, pulmonary embolism).

(I21.01-I21.4, I21.9) Acute Myocardial Infarction: Type I MI (Must meet Criteria #1 AND either Criteria #2 OR one or more from Criteria #3 is needed to make the diagnosis):

1) Rise and/or fall of cardiac troponin with at least one value above the 99th percentile URL**, **AND**
2) Symptoms of acute myocardial ischemia (chest pressure, dyspnea, diaphoresis, weakness, nausea/vomiting, syncope and/or pain in the left arm, upper back and jaw), **OR**
3) Evidence of coronary artery thrombosis (caused by an atherosclerotic plaque fissure, erosion or rupture) manifested as:
    a. New ischemic EKG changes, **OR**
        i. ST-segment elevation or depression
        ii. Inverted T waves
        iii. Development of pathological Q waves
    b. Imaging evidence of new loss of viable myocardium or new regional wall abnormality, in a pattern consistent with an ischemic etiology:
        i. ECHO showing new regional wall abnormality, systolic and/or diastolic dysfunction or reduced ejection fraction
        ii. Radionuclide imaging showing regional wall motion abnormalities, infarction or reduced ejection fraction
        iii. Cardiac catheterization and angiography showing presence of a coronary thrombus

(I21.3) ST-elevation MI: (Must meet Criteria #1 and ONE of the following from Criteria #2 a or b is needed to make the diagnosis):[4,5]

1) Meets diagnostic criteria for Acute Myocardial Infarction (as listed above), **AND**
2) EKG findings with:
    a. A persistent (>20 minutes) ST-segment elevation, **OR**
    b. A new left bundle-branch block **WITH** symptoms, **AND**
        i. Concordant ST-segment elevation of ≥ 1 mm in leads with a positive QRS complex, **OR**
        ii. Concordant ST-segment depression of ≥ 1 mm in V1-V3, **OR**
        iii. ST-segment elevation at the J-point, relative to the QRS onset, is at least 1 mm and has an amplitude of at least 25% of the preceding S-wave.[6]

(I21.4) non-ST-elevation MI: (Must meet Criteria #1 + Criteria #2 is needed to make the diagnosis):

1) Meets diagnostic criteria for Acute Myocardial Infarction (as listed above), **AND**
2) EKG findings showing transient ST-segment elevation, ST-segment depression, T-wave inversion or no ischemic changes (normal EKG). [4,5]

Codes from category I21 (acute MI) can be reported while the myocardial infarction is equal to or less than four weeks (28) days old, including transfers to another acute setting or a post-acute setting. After the four-week timeframe, if the patient is still receiving care for the MI, the appropriate aftercare code should be assigned rather than a code from category I21.[1,2]

(I21.A1) Type 2 MI[1-2, 7] (ALL of the following Criteria #1- Criteria#5 and ONE or more of the following from Criteria #6 or Criteria #7):

1) An elevated but changing troponin with at least one value above the 99th percentile URL, **AND**
2) Documentation of the clinical condition (etiology) causing or suspected to be causing the increase in oxygen demand or decrease in oxygen supply, **AND**
3) Clinical features inconsistent with Type I acute MI, **AND**
4) Stress test or ECHO rules out a coronary cause or angiography shows no evidence of clinically significant coronary lesions[6]: **AND**
5) Treatment plan focuses on correcting the documented cause of the supply/demand mismatch rather than treating atherothrombosis, **AND**
6) Symptoms of acute myocardial ischemia (chest pressure, dyspnea, diaphoresis, weakness, nausea/vomiting, syncope and/or pain in the left arm, upper back and jaw), **OR**
7) Documentation of new ischemic EKG changes

5) Common Causes of Myocardial Infarction:[8]

- Type 1 MI: results from an atherosclerotic plaque fissure, erosion or rupture with subsequent coronary artery thrombosis. Type I myocardial infarctions are further differentiated as STEMI or NSTEMI. STEMIs represent complete occlusion of a coronary vessel. NSTEMIs result from incomplete or partial occlusion of coronary vessels.
- Type 2 MI: result from an oxygen supply/demand imbalance. Causes can be coronary or non-coronary in origin including cardiomyopathy, pulmonary embolism, atrial fibrillation, severe anemia and hypovolemic or septic shock.

Clinical Indicators of Myocardial Infarction:

- Chest pain (pressure, heaviness, tightness or constriction) or palpitations
- Neck, jaw, shoulder or arm pain
- Nausea, vomiting, sweating, profound fatigue or weakness
- Syncope or presyncope
- Some patients, particularly diabetics and the elderly, experience only minimal symptoms or no symptoms at all.[2]
- Women often present with atypical chest pain and angina-equivalent symptoms such as dyspnea, weakness, fatigue, and indigestion.[9]

Differential Diagnoses for Myocardial Infarction:

(I20.1) Prinzmetal angina/coronary artery vasospasm/variant angina: a form of angina that can occur at rest (without exertion) and can result in a transient ST segment elevation on EKG. It results from a temporary increase in coronary vascular tone (vasospasm) which causes a transient reduction in coronary artery luminal diameter. In contrast, angina is caused by permanent occlusion of the vessels by build-up of plaque (atherosclerosis). Patients are predominantly younger women who lack the classic cardiovascular risk factors.[10]

(I25.2) Spontaneous coronary artery dissection: a non-iatrogenic, non-traumatic separation of the coronary artery wall that can lead to myocardial ischemia and ultimately acute coronary syndrome. It is most prevalent among middle-aged women. Risk factors include pregnancy, exogenous hormone use, and inflammatory and connective tissue disorders. The gold standard for diagnosis is a coronary angiography.[11]

(I44.7) Left bundle branch block, unspecified. In the new American College of Cardiology (ACC) guidelines, a new LBBB alone is no longer considered a STEMI equivalent. Patients with a LBBB, must have symptoms **AND** one of the following EKG changes to be considered to have a STEMI equivalent.

- Concordant ST-segment elevation of ≥ 1 mm in leads with a positive QRS complex
- Concordant ST-segment depression of ≥ 1 mm in V1-V3
- ST-segment elevation at the J-point, relative to the QRS onset, is at least 1 mm and has an amplitude of at least 25% of the preceding S-wave.[6]

References:

1) Tang, C., Pinson, R. (2023). Myocardial Injury, Ischemia, Infarction. CDI Pocket Guide (16th Edition), Pages 173-179.

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4) Cohen M, Visveswaran G. Defining and Managing Patients with non-ST-elevation Myocardial Infarction: Sorting Through Type 1 vs Other Types. Clin Cardiol. 2020 Mar; 43 (3): 242-250.

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6) Das D, McGrath BM. Sgarbossa criteria for acute myocardial infarction. CMAJ. 2016 Oct 18;188(15):E395.

7) Collinson PO, Lindahl L. Diagnosing Type 2 Myocardial Infarction. J Am Coll Cardiol 2016;48:197-200.

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9) Wenger NK. Angina in women. Curr Cardiol Rep. 2010;12:307–314.

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11) Agwuegbo CC, Ahmed EN, Olumuyide E, et al. Spontaneous Coronary Artery Dissection: An Updated Comprehensive Review. Cureus 2024; 16(2).

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SUPPLEMENTS:

(A) Types of Myocardial Infarctions:[12]

Type	Clinical classification of MI[1]
Type 1	Spontaneous MI
Type 2	MI secondary to ischaemic imbalance
Type 3	MI resulting in death without biomarkers
Type 4a	MI related to PCI
Type 4b	MI related to stent thrombosis
Type 5	MI related to CABG

1. Thygesen K, et al. Universal definition of myocardial infarction. *J Am Coll Cardiol* 2012;60(16):1581-1598.

(B) Acute Myocardial Injury versus Acute Myocardial Infarction:[8]