Coronary Microvascular Dysfunction (CMD) ICD-10-CM Proposal

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Relevant disclosures

Consultancy

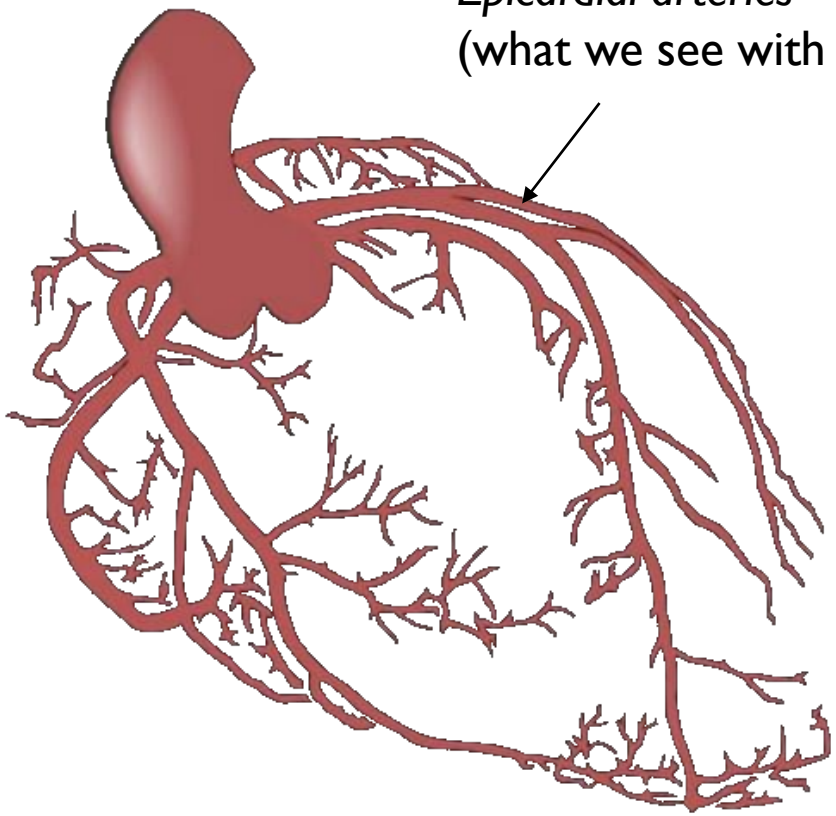
(coronary imaging & physiology)

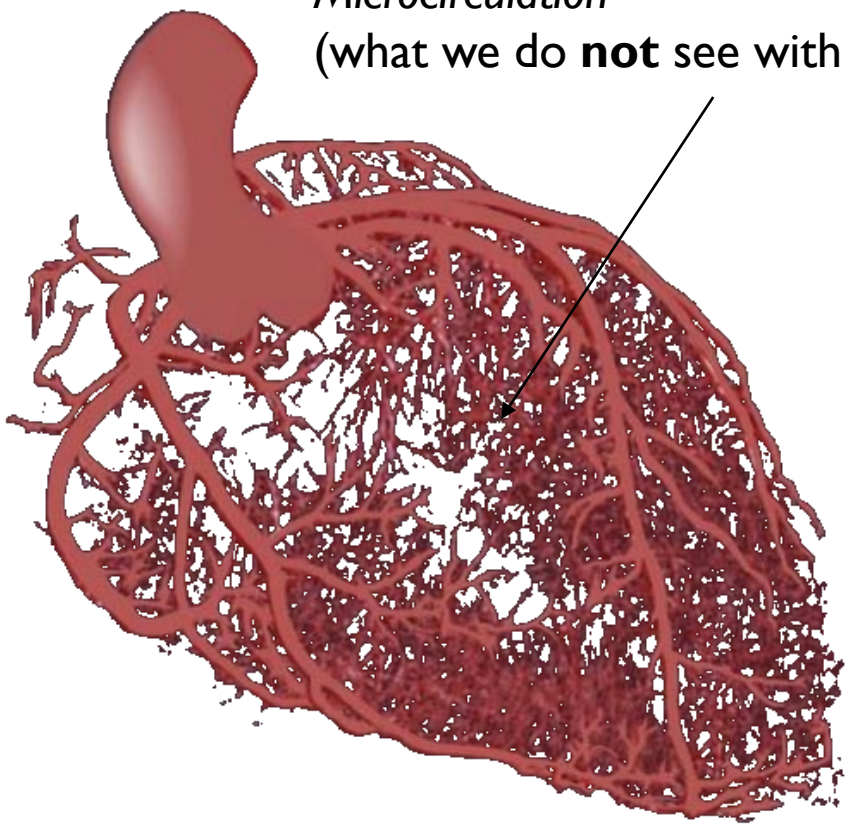
Abbott

Boston Scientific

Philips

Structure of coronary circulation





Taqueti et al. J Am Coll Cardiol. 2018 November 27; 72(21): 2625–2641.

Need for microvascular assessment

- A significant number of patients presenting with angina may benefit from microvascular diagnostic testing:
  - Ischemia with No Obstructive Coronary Artery disease (INOCA)
  - Post-PCI patients' persistent angina may be caused by CMD
  - Acute coronary syndromes without obstructive coronary disease (MINOCA) may be related to CMD

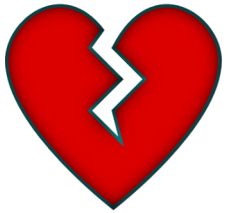
➢ Patients who receive a diagnosis and stratified medical therapy have improved Quality of Life indices

40-60%

of patients seen in the catheterization lab have ischemia and no obstructive CAD (INOCA)[1]

20-40%

of patients continue to have angina post-PCI[2]



c.5%

of patients presenting with acute coronary syndromes/heart attack have no obstructive CAD (MINOCA)[3]

1. Patel et al. Low diagnostic yield of elective coronary angiography. NEJM 2010.
2. Crea et al. Mechanisms and diagnostic evaluation of persistent or recurrent angina following percutaneous coronary revascularization. EHJ 2019.
3. Tamis-Holland et al. Contemporary Diagnosis and Management of Patients With Myocardial Infarction in the Absence of Obstructive Coronary Artery Disease: A Scientific Statement From the American Heart Association. Circulation 2019.

Diagnostic pathway: stable angina

Stable Angina Patients who undergo Coronary Angiography

41% may have obstructive CAD[1]
(defined as ≥50% vessel stenosis)

59% may not have obstructive disease[1]

Coronary Epicardial Disease:

- Using fractional flow reserve (FFR) to determine need for revascularization can improve outcomes and lower adverse events[3]
- But post- percutaneous coronary intervention (PCI) angina occurs in 20-30% of patients at 1 year[4]
- Diagnosing coronary microvascular dysfunction (CMD) at the initial PCI or subsequent visit may improve outcomes and provide peace of mind to patients[5]

Coronary Microvascular Dysfunction:

- Using coronary flow reserve (CFR) and index of microvascular resistance (IMR) to diagnose these patients allows for a stratified medical approach, which can improve outcomes and Quality of Life indices[2]
- Disease management may include:
  - Pharmacological treatment
  - Cardiac rehabilitation
  - Lifestyle changes

1. Patel et al. Low diagnostic yield of elective coronary angiography. NEJM 2010.
2. Ford et al. J Am Coll Cardiol Intv. 2020;13(1):33-45.
3. Tonino et al. N Engl J Med 2009; 360:213-224.
4. Jeremias et al. DEFINE PCI. ACC 2019.
5. Taqueti et al. Coronary Microvascular Disease Pathogenic Mechanisms and Therapeutic Options. JACC 2018.

INOCA is ***not*** benign

- INOCA patients historically thought to be at low risk for major adverse cardiovascular events (MACE)[1]
- ***<u>Recent data show INOCA patients carry elevated MACE risk up to 2x that of patients with normal coronary arteries and no angina</u>***[1]
- Coronary Microvascular Dysfunction (CMD) is a common cause of INOCA and cannot be diagnosed by angiography alone.[2]

Stratified MACE rates for CAD patients[1]

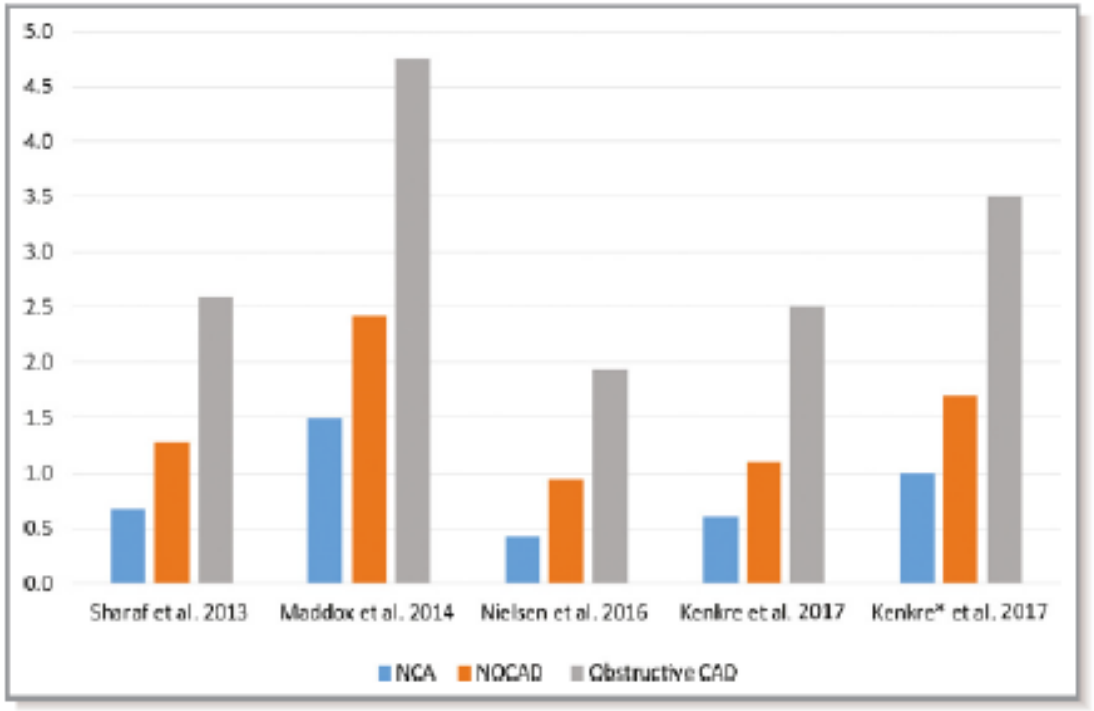


Figure 1. Annual MACE rate stratified by normal coronary arteries, nonobstructive CAD, and obstructive CAD. Annual MACE rates from the reported mean MACE rate divided by the mean years of follow-up. CAD indicates coronary artery disease; MACE, major adverse cardiovascular events; NCA, normal coronary arteries; NOCAD, nonobstructive coronary artery disease. Outcomes include: Sharaf[47]: cardiovascular death or nonfatal MI; Maddox[4]: all-cause mortality or nonfatal MI; Nielsen[41]: all-cause death, MI, late coronary revascularization; Kenkre[16]: cardiac mortality; Kenkre[16]*, all-cause death.

1. Herscovici et al. Ischemia and No Obstructive coronary artery Disease (INOCA): What is the risk? JAHA. 2018.
2. Vancheri et al. Coronary Microvascular Dysfunction. J Clin Med. 2020.

MINOCA and microvascular assessment

- MINOCA: **M**yocardial **I**nfarction and **NO**nobstructive **C**oronary **A**rteries
- Acute Coronary Syndrome
- Elevated troponin levels
- MINOCA ≈ 5% to 6% of all patients with acute infarction referred for coronary angiography. There are a variety of causes that can result in this clinical condition, including CMD[1]
- CMD usually presents as stable coronary artery disease (CAD) but may also present as acute coronary syndrome (ACS) and be a cause of MINOCA[3]

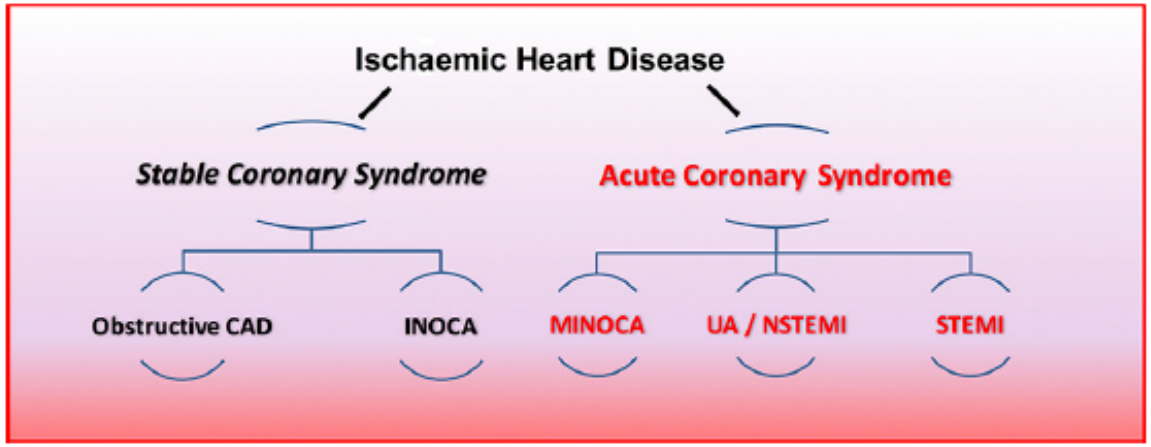


Figure 1 Hierarchical nomenclature of coronary artery disease endotypes that cause ischaemic heart disease. Modified with permission.[2] CAD, coronary artery disease; INOCA, ischaemia and no obstructive coronary artery disease; MINOCA, myocardial infarction with no obstructive coronary artery disease.

1. Tamis-Holland et al., Circulation. 2019;139:e891–e908
2. Ford et al; Heart 2018; 104(4): 284-292
3. Shamsi et al., J Saudi Heart Assoc. 2021;33(1):9-15

Chest Pain Guidelines recommend CMD testing

AHA/ACC CLINICAL PRACTICE GUIDELINE

2021 AHA/ACC/ASE/CHEST/SAEM/SCCT/SCMR Guideline for the Evaluation and Diagnosis of Chest Pain

A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

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American Heart Association.

5.2.3. Patients With Suspected Ischemia and No Obstructive CAD (INOCA)

1. Bairey Merz CN, Pepine CJ, Walsh MN, et al. Ischemia and no obstructive coronary artery disease (INOCA): developing evidence-based therapies and research agenda for the next decade. *Circulation*. 2017;135:1075–1092.
2. AlBadri A, Bairy Merz CN, Johnson BD, et al. Impact of abnormal coronary reactivity on long-term clinical outcomes in women. *J Am Coll Cardiol*. 2019;73:684–693.
3. AlBadri A, Sharif B, Wei J, et al. Intracoronary bolus injection versus intravenous infusion of adenosine for assessment of coronary flow velocity reserve in women with signs and symptoms of myocardial ischemia and no obstructive coronary artery disease. *J Am Coll Cardiol Intv*. 2018;11:2125–2127.
4. Ford TJ, Stanley B, Sidik N, et al. 1-Year outcomes of angina management guided by invasive coronary function testing (CorMicA) *J Am Coll Cardiol Intv*. 2020;13:33–45.

Recommendations for Patients With INOCA
Referenced studies that support the recommendations are summarized in Online Data Supplements 36 and 37.

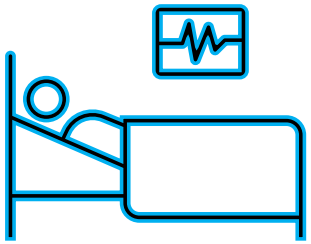
COR	LOE	Recommendations
2a	B-NR	1. For patients with persistent stable chest pain and nonobstructive CAD and at least mild myocardial ischemia on imaging, it is reasonable to consider invasive coronary function testing to improve the diagnosis of coronary microvascular dysfunction and to enhance risk stratification.[1-4]
2a	B-NR	2. For patients with persistent stable chest pain and nonobstructive CAD, stress PET MPI with MBFR is reasonable to diagnose microvascular dysfunction and enhance risk stratification.[5-11]
2a	B-NR	3. For patients with persistent stable chest pain and nonobstructive CAD, stress CMR with the addition of MBFR measurement is reasonable to improve diagnosis of coronary myocardial dysfunction and for estimating risk of MACE.[12-14]
2b	C-EO	4. For patients with persistent stable chest pain and nonobstructive CAD, stress echocardiography with the addition of coronary flow velocity reserve measurement may be reasonable to improve diagnosis of coronary myocardial dysfunction and for estimating risk of MACE.

CLINICAL STATEMENTS AND GUIDELINES

Gulati et al. 2021 AHA/ACC/ASE/CHEST/SAEM/SCCT/SCMR Guideline for the Evaluation and Diagnosis of Chest Pain. Circulation 2021.

Unmet clinical needs in CMD/INOCA

1. Streamlining of patient journey from presentation to diagnosis (and to treatment)
2. Reduction in resource utilization from unnecessary (and repeated) diagnostic testing
3. Linking of patient presentation with specific diagnosis to facilitate data collection



*While clinical findings validate the importance of accurately diagnosing CMD, the structure of available diagnosis codes (ICD-10-CM) does not describe the disease:

All of these unmet patient needs could potentially be met through creation of CMD-specific ICD-10-CM codes

Thank you for your attention