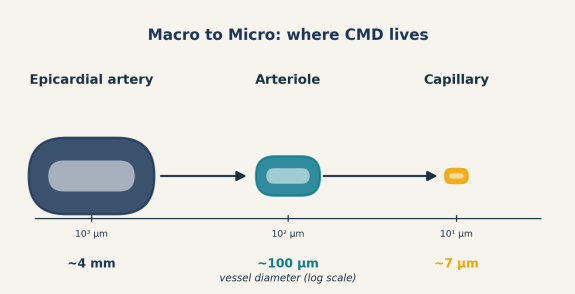
Understanding Coronary Microvascular Dysfunction

Chest pain and ischemia when the heart's small vessels misbehave

Real disease. Real treatment. Even when the cath looks clean.



Online: https://go.riasalimd.com/cmd-guide

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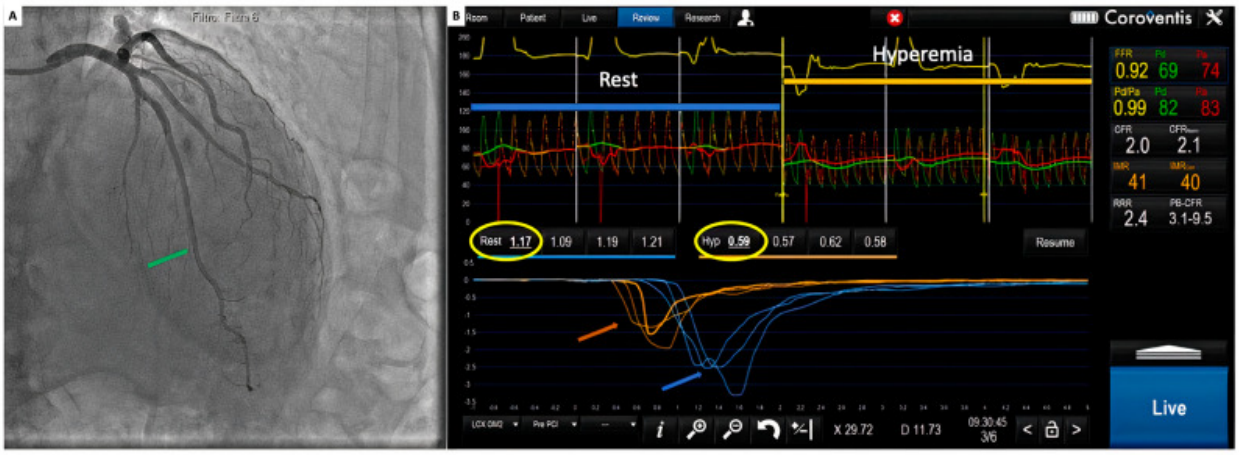
Names & Terms You Will Hear

Term	Meaning
Coronary microvascular dysfunction (CMD)	A problem with the heart's smallest arteries.
Microvascular angina (MVA)	Chest pain caused by CMD. This is the name your doctor may use.
INOCA	Stands for: ischemia with non-obstructive coronary arteries. The heart is short of blood. Yet the main arteries look open.
ANOCA	Stands for: angina with non-obstructive coronary arteries. This is the chest-pain form of INOCA.
Cardiac Syndrome X	An old name from 1973. It has mostly been replaced by microvascular angina.
Small vessel disease	A term patients often hear. It can be vague. Ask your doctor what it means for you.

What Is Coronary Microvascular Dysfunction?

- Your heart gets blood through three large arteries. An angiogram can see those. But the heart also has millions of tiny vessels. Those are the **coronary microvasculature**.
- When the small vessels cannot open or stay open, the heart can run short of blood. This can happen even when the big arteries look normal.
- Three things cause CMD: **endothelial dysfunction** (the lining will not relax), **smooth-muscle dysfunction** (microvascular spasm), and **structural remodeling** (small vessels are stiffer or fewer than normal).
- Symptoms feel like classic angina — pressure, tightness, or jaw/arm pain. They can come on with exertion, stress, cold air, or even at rest. Episodes can last longer than typical angina.
- CMD is more common in women. But men get it too. It often overlaps with vasospasm and with HFpEF (stiff-heart failure).



A real invasive microvascular test. Left: the angiogram with the pressure wire (green arrow) in place. Right: the console readout comparing blood flow at rest and during hyperemia (medicine-induced peak flow) — this is how CFR and IMR are measured. Image: Ciaramella et al., Diagnostics 2024 (CC BY 4.0).

Why It Matters

- CMD is **not** harmless. Patients with microvascular ischemia have higher rates of heart attack and hospitalization. This is true even with a clean angiogram.
- CMD is one of the most common reasons women still have chest pain after a 'normal' cath.
- Untreated CMD can lead to HFpEF (stiff-heart failure). The small vessels feed the heart's relaxation process.
- The right diagnosis stops the cycle of repeat ED visits and repeat testing. It lets your team treat the real problem.

Risk Factors

Some patients are more likely to develop this condition. Knowing your risk helps your care team take extra precautions.

Risk Factor	Why It Increases Risk
Female sex	Estrogen changes around menopause affect small-vessel tone. Women are more often affected.
Diabetes	High blood sugar harms the vessel lining. It speeds up structural damage to small vessels.
High blood pressure	Long-standing pressure thickens arteriole walls. This reduces blood flow reserve.
High cholesterol / low HDL	Damages the vessel lining. This happens before plaque builds in the big arteries.
Smoking	Directly harms the vessel lining. It lowers the level of nitric oxide in the blood.
Inflammation / autoimmune disease	Lupus, RA, and scleroderma cause chronic inflammation. This damages small vessels.
Obesity & metabolic syndrome	Insulin resistance harms small-vessel function. Fat-tissue signals make this worse.
HFpEF (stiff-heart failure)	CMD and HFpEF often occur together. They share the same biology.
Prior chest radiation	Radiation speeds up scarring and loss of small vessels.
Post-COVID / long COVID	Viral illness can harm the vessel lining. This is now a known CMD trigger.

Treatment Options

- **Risk factor control comes first.** Managing blood pressure, cholesterol, blood sugar, weight, and smoking helps more than any single pill.
- **Beta-blocker** (carvedilol, nebivolol) — lowers heart-rate demand. Often the first drug used.
- **Calcium channel blocker** (amlodipine, diltiazem) — used when microvascular spasm is suspected. Also helps if epicardial vasospasm overlaps.
- **Ranolazine** — blocks a channel that makes the heart work harder. Well studied in microvascular angina. Used when a beta-blocker alone is not enough.
- **ACE inhibitor or ARB** (lisinopril, losartan) — helps the vessel lining work better. Slows small-vessel damage.
- **High-intensity statin** — benefits the vessel lining beyond just lowering LDL.
- **Nitrates** — can help some patients. They often work less well in CMD than in blocked-artery angina. Sublingual nitro can be tried for acute episodes.
- **Cardiac rehabilitation** — supervised exercise improves small-vessel function and quality of life. This therapy is greatly underused.
- **Treat the overlap** — add a CCB if vasospasm is found. Consider an SGLT2 inhibitor if HFpEF is also present.

Risks, Benefits, and Alternatives

Every choice has trade-offs. Use this table to start the shared decision conversation.

Option	Risks	Benefits	Alternatives
Medication therapy (beta-blocker, CCB, ranolazine, statin, ACE/ARB)	Side effects may include fatigue, low BP, or constipation. Ranolazine can interact with some drugs.	Most patients improve. Drugs are cheap and reversible. No procedure needed.	Lifestyle changes only; or do invasive testing first to guide drug choice.
Invasive coronary function testing (CFR, IMR, acetylcholine provocation)	Small risk of arrhythmia or spasm during the test. Access-site bruising. Radiation and contrast used.	Confirms the diagnosis. Targets treatment precisely. The CorMicA trial showed real quality-of-life gains.	Try drug therapy first; or use non-invasive PET or CMR imaging.
Non-invasive PET or stress CMR perfusion	Can be costly. Insurance coverage is uneven. Not available everywhere.	No catheter needed. Can confirm microvascular ischemia without a procedure.	Invasive testing; or try drug therapy first.
Lifestyle changes only (no medication)	Symptoms and risk factors may stay poorly controlled. Ischemia can continue.	No drug side effects.	Add medication; enroll in a cardiac rehab program.

Common Misconceptions

Myth	Reality
"My catheterization was normal, so my heart is fine."	A normal cath only rules out major-artery blockage. It does NOT rule out CMD. CMD carries real cardiac risk.
"It's just anxiety — my chest pain isn't real."	CMD is a real, measurable disease. Coronary reactivity tests show abnormal results. Anxiety can coexist, but CMD is not in your head.
"Women don't get heart disease, so this can't be cardiac."	Heart disease is the #1 killer of women in the US. Women more often have CMD than blocked arteries. It is often missed.
"Nitroglycerin doesn't help, so it isn't from the heart."	Nitrates often help less in CMD than in obstructive CAD. A weak nitro response does NOT rule out cardiac chest pain.
"There's no treatment, so why bother diagnosing it?"	There IS treatment. The CorMicA trial showed targeted therapy improves symptoms and quality of life.
"If it were serious, my stress test would have caught it."	Standard stress tests miss many cases of microvascular disease. PET, CMR, and invasive function testing are more accurate.

Possible Complications

Knowing what can go wrong helps you spot problems early. Most complications are uncommon, especially with treatment.

Where / What	What Can Happen
Heart attack (type 2 MI or MINOCA)	Ongoing microvascular ischemia can injure the heart muscle. This can happen even without a blocked artery.
Progression to HFpEF	CMD and stiff-heart failure share the same biology. CMD can lead to HFpEF over the years.
Recurrent angina / repeat ED visits	Without the right diagnosis and treatment, pain and testing can continue for years.
Worsened quality of life and depression	Chronic unexplained chest pain takes a real mental toll. Getting a clear diagnosis helps.
Adverse cardiovascular events	Patients with confirmed microvascular ischemia have higher rates of serious heart events.

Points to Know

If you remember nothing else, remember these key points.

- A normal angiogram does not mean your heart is fine.
- If chest pain continues after a clean cath, ask about **microvascular function testing** — CFR, IMR, acetylcholine provocation, or PET/CMR perfusion.
- Treatment works. Most people improve with beta-blocker, CCB, ranolazine, ACE/ARB, statin, and supervised exercise.
- CMD can overlap with vasospasm and HFpEF. Treating the overlap matters.
- Cardiac rehab is one of the most underused therapies for CMD. Ask about it.
- Do not accept "it's just anxiety" as a final answer for unexplained chest pain.

When to Call Us - and When to Call 911

If you are not sure, call. We would rather hear from you twice than miss a real problem.

- **Call 911** if chest pain lasts more than 5 minutes and does not ease with rest or nitro.
- **Call 911** if chest pain comes with fainting, severe shortness of breath, cold sweat, or new arm or jaw pain.
- **Call our office** if your chest pain gets more frequent, comes on with less effort, or wakes you from sleep.
- **Call our office** if you need sublingual nitroglycerin more than once a week.
- **Call our office** if your medications cause side effects you cannot tolerate. We will adjust your regimen.
- **Call our office** if another doctor stops or changes your CMD medications without talking to our team.
- **Call our office** if you are pregnant, planning pregnancy, or breastfeeding. Some CMD medications need to be adjusted.

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Trusted Resources

The links below are the trusted resources Dr. Ali used to write this guide and that he recommends you visit for more information. Each is a clickable link in the digital version and a Short.io tracked URL on the printed version.

- AHA Scientific Statement on CMD (2020) - The main expert consensus paper on CMD. Good for clinicians and patients.
- NHLBI — Coronary Microvascular Disease - Plain-language overview from the National Heart, Lung, and Blood Institute.
- Mayo Clinic — Microvascular Disease - Covers symptoms, causes, and how CMD is diagnosed.
- AHA Go Red for Women — Coronary Microvascular Disease - Focuses on the impact of CMD in women.
- WomenHeart — The National Coalition for Women with Heart Disease - Peer support for women living with heart disease, including CMD.

Sources Used to Build This Guide

Every recommendation in this guide is grounded in one or more of the studies, guidelines, or trusted resources below. Short links are tracked so Dr. Ali can see which references patients are reading; nothing personally identifying is captured.

- AHA Scientific Statement: Coronary Microvascular Dysfunction (2020) *[Guideline / Scientific Statement]*
  Authoritative consensus on definition, mechanisms, diagnosis (CFR/IMR), and treatment of CMD. Anchors the entire guide.
- COVADIS criteria for microvascular angina (Ong et al, 2018) *[Consensus Criteria]*
  International standardized diagnostic criteria for microvascular angina; used in the diagnosis section.
- ESC 2024 Chronic Coronary Syndromes Guideline *[Guideline]*
  Expanded ANOCA/INOCA framework, microvascular reactivity testing recommendations, treatment hierarchy.
- WISE study: Women's Ischemia Syndrome Evaluation (NHLBI) *[Cohort Study]*
  Landmark evidence that non-obstructive CAD with ischemia carries substantial cardiac risk; foundation for the 'normal cath is not normal' misconception.
- CorMicA randomized trial: invasive precision medicine for INOCA *[Randomized Trial]*
  RCT evidence that stratified medical therapy based on coronary function testing improves angina and QoL.
- Mayo Clinic — Coronary Microvascular Disease *[Patient Education]*
  Plain-language framing of symptoms and risk factors; used to validate lay-language phrasing.
- NHLBI — Coronary Microvascular Disease *[Patient Education]*
  Federally-sourced patient overview; trusted resources section.
- AHA Go Red for Women — Coronary Microvascular Disease *[Patient Education]*
  Disproportionate impact in women framing; misconceptions section.
- Crea F, Camici PG, Bairey Merz CN. Coronary microvascular dysfunction: an update. Eur Heart J 2014. *[Review]*
  Mechanism review (endothelial, smooth muscle, structural) for the mechanisms section.
- Marinescu MA et al. Coronary Microvascular Dysfunction, Microvascular Angina, and Treatment Strategies. JACC Imaging 2015. *[Review]*
  Treatment hierarchy (beta-blocker, CCB, ranolazine) evidence base.

About This Guide

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Reviewer note: Reviewed against Mayo Clinic, NHLBI, and AHA Go Red for Women CMD pages. Ours adds: clear mechanism naming (endothelial vs smooth-muscle vs structural), the COVADIS diagnostic criteria, the CorMicA precision-medicine framework, and explicit cross-links to vasospasm and HFpEF.

Disclaimer

This guide is for educational purposes only and does not replace medical advice from your physician. Recommendations may not apply to every patient. Always follow the specific instructions of Dr. Ali and your care team. In an emergency call 911 or go to the nearest emergency department.

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