

Invasive Coronary Angiography (ICA)

Invasive coronary angiography (ICA) is used to define the **presence, severity, and anatomic characteristics** of obstructive disease in the epicardial coronary arteries, including lesion location, length, diameter, and associated coronary blood flow^{1,2}. The primary clinical objective of ICA is the identification of **high-grade obstructive stenoses** in order to determine the feasibility and necessity of **percutaneous or surgical revascularization**. Physiologic indices such as **fractional flow reserve (FFR)** and **instantaneous wave-free ratio (iFR)** provide complementary functional information beyond anatomic assessment¹.

Radiation exposure during ICA averages **4-10 mSv**, with dose dependent on procedural duration and complexity^{3,4}. Although ICA offers high spatial resolution (~0.3 mm), it cannot visualize **coronary arterioles**, which are smaller (~0.1 mm) and play a central role in regulating myocardial blood flow⁵. As a result, **normal angiographic findings do not exclude abnormal coronary vascular function**.

Assessment of **coronary microvascular function and vasomotion** can be performed during coronary angiography using invasive coronary function testing. These evaluations may assist in management of underlying coronary dysfunction and provide important **prognostic information**, particularly in patients without obstructive coronary artery disease⁶⁻⁸.

Coronary CT Angiography (CCTA): Practical Limitations and Contraindications

Coronary CT angiography (CCTA) is a noninvasive anatomic imaging modality used to evaluate coronary atherosclerosis and exclude obstructive coronary artery disease in appropriately selected patients. However, its diagnostic accuracy and safety may be limited under certain clinical conditions.

CCTA is **contraindicated or limited** in the following situations:

- **Allergy to iodinated contrast media**
- **Inability to cooperate with image acquisition**, including inability to follow breath-hold instructions
- **Clinical instability**, including:
 - Acute respiratory distress
 - Severe hypotension
 - Unstable arrhythmias
- **Renal impairment**, as defined by institutional contrast safety protocols
- **Inability to achieve adequate heart rate control**, including:
 - Contraindications to beta-blockers
 - Lack of alternative rate-controlling medications
- **Significant heart rate variability or frequent arrhythmia**, which may degrade image quality
- **Contraindication to nitroglycerin**, when required as part of the imaging protocol

Recognition of these limitations is essential when selecting anatomic testing strategies and may necessitate alternative diagnostic approaches, including functional testing or invasive coronary angiography, depending on the clinical context.

References

1. Fihn SD, Gardin JM, Abrams J, et al. 2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS guideline for the diagnosis and management of patients with stable ischemic heart disease. *Circulation*. 2012;126:e354–e471.
2. Amsterdam EA, Wenger NK, Brindis RG, et al. 2014 AHA/ACC guideline for the management of patients with non-ST-elevation acute coronary syndromes. *Circulation*. 2014;130:e344–e426.
3. Kobayashi T, Hirshfeld JW Jr. Radiation exposure in cardiac catheterization: operator behavior matters. *Circ Cardiovasc Interv*. 2017;10:e005689.
4. Georges JL, Karam N, Tafflet M, et al. Time-course reduction in patient exposure to radiation from coronary interventional procedures. *Circ Cardiovasc Interv*. 2017;10:e005268.
5. Ford TJ, Corcoran D, Berry C. Stable coronary syndromes: pathophysiology, diagnostic advances and therapeutic need. *Heart*. 2018;104:284–292.
6. Taqueti VR, Shaw LJ, Cook NR, et al. Excess cardiovascular risk in women relative to men referred for coronary angiography is associated with severely impaired coronary flow reserve, not obstructive disease. *Circulation*. 2017;135:566–577.
7. Ong P, Camici PG, Beltrame JF, et al. International standardization of diagnostic criteria for microvascular angina. *Int J Cardiol*. 2018;250:16–20.
8. Ford TJ, Stanley B, Good R, et al. Stratified medical therapy using invasive coronary function testing in angina: the CorMicA Trial. *J Am Coll Cardiol*. 2018;72:2841–2855.