

CASE REPORT

ADVANCED

CORONARY ARTERY REVASCULARIZATION GUIDELINES: CLINICAL CASE SERIES

# Putting the 2021 ACC/AHA/SCAI Guideline for Coronary Artery Revascularization Into Practice



## A Case Series

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### ABSTRACT

This case series shows how the 2021 ACC/AHA/SCAI guideline for coronary artery revascularization can be used to decide between revascularization or optimal medical therapy to reduce mortality or cardiovascular events in selected subsets of patients with stable ischemic heart disease and complex coronary disease with or without left ventricular dysfunction. **(Level of Difficulty: Advanced.)** (J Am Coll Cardiol Case Rep 2022;4:31-35) © 2022 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

**T**he ISCHEMIA (International Study of Comparative Health Effectiveness with Medical and Invasive Approaches) (1) trial challenged the conventional wisdom that routine revascularization with either coronary artery bypass

graft (CABG) surgery or percutaneous coronary intervention (PCI) improves survival in patients with multivessel (MV) coronary artery disease (CAD) and stable ischemic heart disease (SIHD), a belief that was based on the results of several early studies and a meta-analysis (2). The writing committee for the 2021 ACC/AHA/SCAI guideline for coronary artery revascularization (3) has interpreted the results of the new trial (1) against the background of prior evidence to identify patient subsets likely to experience a survival advantage with revascularization. The following case series illustrates how clinicians can use the 2021 guideline (3) to determine which patients with SIHD may have improved survival or reduced cardiovascular events after undergoing revascularization as compared with using medical therapy (MT) alone.

### LEARNING OBJECTIVES

- To identify the anatomic subgroups in which revascularization may confer a survival advantage over MT.
- To appreciate that individualized decisions regarding revascularization strategies with either CABG or PCI can reduce cardiovascular events or alleviate ischemic symptoms in patients with SIHD.

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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the [Author Center](#).

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## ABBREVIATIONS AND ACRONYMS

<b>BP</b>	= blood pressure
<b>CABG</b>	= coronary artery bypass graft
<b>CAD</b>	= coronary artery disease
<b>EF</b>	= ejection fraction
<b>LAD</b>	= left anterior descending artery
<b>LM</b>	= left main
<b>LV</b>	= left ventricular
<b>MT</b>	= medical therapy
<b>MV</b>	= multivessel
<b>PCI</b>	= percutaneous coronary intervention
<b>RCA</b>	= right coronary artery
<b>SIHD</b>	= stable ischemic heart disease

## CASE REPORTS

**CASE 1: MV-CAD AND LEFT VENTRICULAR DYSFUNCTION BUT MINIMAL SYMPTOMS.** A 69-year-old woman with a 3-month history of dyspnea had a positive stress test result. The past medical history was notable for hypertension, hyperthyroidism, and chronic obstructive pulmonary disease but negative for stroke or diabetes. She was treated with aspirin, losartan, metoprolol succinate, and simvastatin. Physical examination showed a well woman in no distress with blood pressure (BP) of 165/86 mm Hg, heart rate of 58 beats/min, clear lungs, and an S<sub>4</sub> gallop. A stress test showed reversible anterior perfusion abnormalities. Cardiac catheterization showed an ejection fraction (EF) of  $\geq 24\%$  and MV-CAD involving the proximal left anterior descending artery (LAD) and right coronary artery (RCA) (**Figure 1, Video 1**).

Evidence supporting revascularization (ie, using CABG) to improve survival in patients with left ventricular (LV) dysfunction and MV-CAD is mixed. The STICH (Surgical Treatment for Ischemic Heart Failure) trial (4) randomized patients with an EF of  $\leq 35\%$  and CAD to CABG versus MT alone and did not find a significant survival difference at 5 years (4), but the extended STICHES (Surgical Treatment for Ischemic Heart Failure [Extended Study]) trial found a survival benefit at 10 years (5). The 2021 ACC/AHA/SCAI guideline for coronary artery revascularization (3) contains a Class 1 recommendation for CABG over MT to improve survival (section 7.1.1, “should be done”).

The patient in the present vignette discussed treatment options with the heart team, including her personal cardiologist, who ascribed dyspnea to ischemic LV dysfunction. After an elective 4-vessel CABG, she had an uneventful recovery and no longer has dyspnea.

**CASE 2: ISOLATED NONCOMPLEX LEFT MAIN CAD AND DIABETES.** A 60-year-old woman with refractory angina was referred for cardiac catheterization. The patient had been well until 6 months earlier, when she experienced exertional substernal pressure, nausea, and lightheadedness. The past medical history was positive for hypertension and diabetes. She was treated with aspirin, metformin, hydrochlorothiazide, bisoprolol, and lovastatin. Physical examination showed BP of 155/73 mm Hg, heart rate of 58 beats/min, and normal examination findings. She did not undergo stress testing, given the high pretest probability of CAD. Cardiac

catheterization with family present showed an LVEF of 65% and an eccentric 75% stenosis of the ostium of the left main (LM) coronary artery (**Figure 2**).

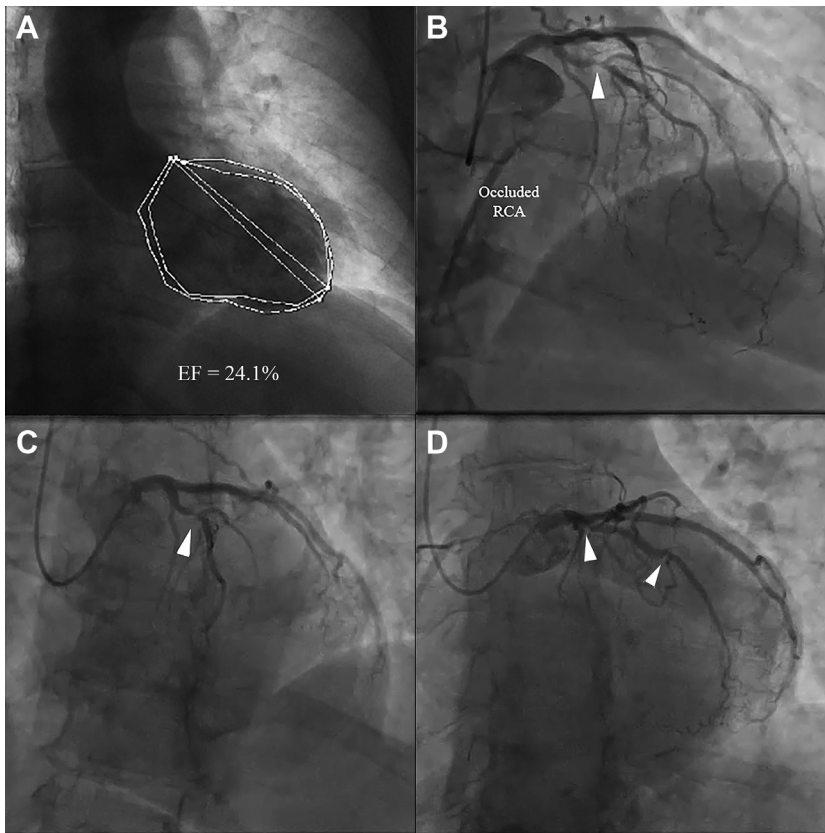
The patient and her family were told that CABG was normally recommended in this circumstance but that PCI was technically feasible and likely beneficial. Early studies comparing CABG with MT in patients with LM-CAD demonstrated a survival advantage of CABG over MT (2), earning CABG a Class 1 recommendation (section 7.1.3, “is recommended”). There is no direct evidence that PCI confers a survival advantage over MT in patients with LM-CAD, but a network meta-analysis found that the survival advantage achieved with PCI over MT in patients with LM-CAD was identical to the survival advantage seen with CABG over MT (6). For this reason, PCI earned a Class 2a recommendation to improve survival over MT in the 2021 guideline (section 7.1.4, “is reasonable”).

In the present context, either approach to revascularization would be appropriate. The 2021 guideline (3) contains a Class 1 preference for CABG over PCI to improve survival in patients with LM disease and high-complexity CAD (section 8.1.1, “is recommended”), but the patient did not have complex CAD. She was impressed with the ease of the radial approach and wished to avoid a thoracotomy despite its known advantages. She opted to undergo PCI (**Video 2**), was discharged from hospital the same day, and has had complete relief of angina.

**CASE 3: MV-CAD, REFRACTORY SYMPTOMS, AND DIABETES.** An 88-year-old man with chest pain was referred for cardiac catheterization. The past medical history was positive for essential tremor complicated by dystonia, mild frailty, hypertension, and diabetes. He was treated with gabapentin, propranolol, and aspirin. Physical examination showed a conversant man with BP of 130/63 mm Hg, heart rate of 57 beats/min, total-body dystonia and dysarthric speech, clear lungs, and normal cardiac examination findings. Stress testing showed a large reversible inferior perfusion abnormality and an EF of 59%. Cardiac catheterization showed severe MV-CAD and an EF of 60% (**Figure 3**).

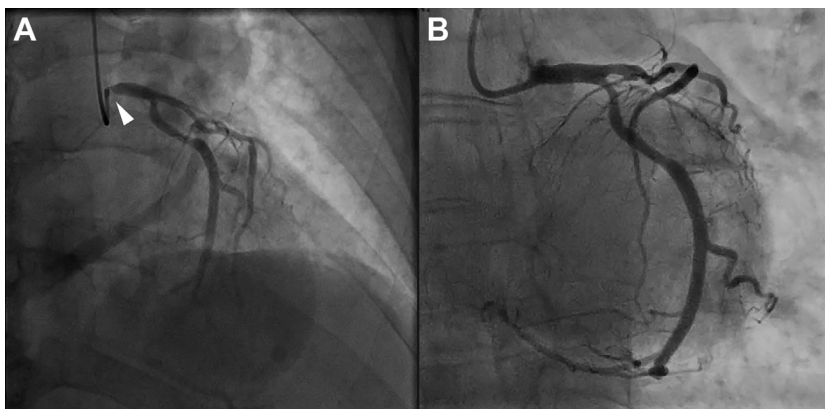
The goal of revascularization in patients with SIHD and MV-CAD is to reduce cardiovascular symptoms or to improve survival. The 2021 guideline (3) gives a class 1 recommendation for either CABG or PCI to reduce ischemic symptoms (section 7.2.2, “is recommended”) based on ample evidence comparing revascularization with MT (7). The 2021 guideline (3) now contains a Class 2a recommendation for selecting CABG or PCI over MT alone to lower the risk of spontaneous myocardial infarction,

**FIGURE 1** Left Ventricular Dysfunction and Multivessel Coronary Artery Disease

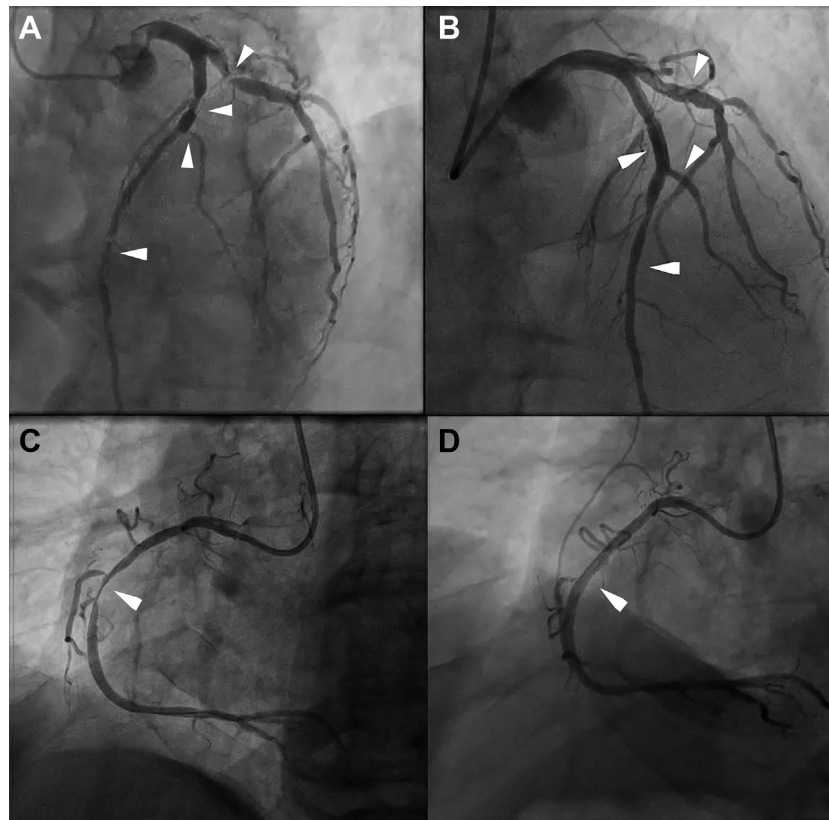


**(A)** A patient with an ejection fraction (EF) of  $\geq 24\%$ . There is **(B)** a totally occluded right coronary artery (RCA), **(B, C)** 70% stenosis in the proximal left anterior descending artery (**arrows**), and **(D)** moderate 50% stenoses in the proximal and mid portions of the left circumflex.

**FIGURE 2** Left Main Coronary Artery Disease



**(A)** A patient with isolated 75% stenosis of the ostium of the left main coronary artery (**arrowhead**), **(B)** successfully treated with a drug-eluting stent.

**FIGURE 3** Multivessel Coronary Artery Disease and Normal Left Ventricular Function

(A, C) A patient with multivessel coronary artery disease (arrowheads), including 80% stenosis of the proximal left anterior descending artery, 90% stenosis of the ostium of the first diagonal branch, 90% stenosis of the midportion of the left anterior descending artery, 85% stenosis of the proximal left circumflex coronary artery, and 80% stenosis of the midportion of the right coronary artery, (B, D) successfully treated with drug-eluting stents.

revascularization, or cardiac death (section 7.3.1, “is reasonable”). On the other hand, the 2021 guideline (3) has downgraded the recommendations for revascularization to improve survival in patients with SIDH and MV-CAD, based on new evidence from ISCHEMIA (1) and multiple meta-analyses incorporating the ISCHEMIA results (8). Significant obstruction in the proximal LAD per se is no longer considered an indication for revascularization to improve survival as compared with MT alone (section 7.2.7, “is uncertain”).

In deciding between CABG and PCI for patients with diabetes and MV-CAD requiring revascularization, the guideline (3) gives a Class 1 preference to CABG (section 8.2.1, “is recommended”). For patients who are poor candidates for surgery, as in this case, the guideline gives a Class 2a recommendation for PCI (section 8.2.2, “can be useful”). Given his advanced age and poor rehabilitation potential, the

patient and the heart team selected the option of PCI, which was carried out in one sitting (Video 3). He underwent successful stenting of all lesions of  $\geq 70\%$  diameter stenosis, given the theoretical advantages of complete revascularization. The patient had immediate resolution of chest pain and has successfully completed a 3-month course of cardiac rehabilitation.

## CONCLUSIONS

The writing committee for the 2021 ACC/AHA/SCAI guideline for coronary artery revascularization (3) has interpreted the results of ISCHEMIA (1,7) against the background of prior evidence and concluded that revascularization may lead to improved survival or better cardiovascular outcomes compared with MT alone in patients with SIHD and the following anatomic subsets:

- Patients with SIHD and MV-CAD suitable for CABG and an EF of  $\leq 35\%$  derive a survival advantage with CABG (section 7.1.1, Class 1), and similar patients with an EF of 35% to 50% may also have a survival advantage with CABG (section 7.1.2, Class 2a).
- Patients with SIHD and significant LM-CAD derive a survival advantage with CABG (section 7.1.3, Class 1) and likely with PCI (section 7.1.4, Class 2a).
- Patients with SIHD and MV-CAD may have a survival advantage with CABG (section 7.1.5, Class 2b), but the advantage with PCI is uncertain (section 7.1.6, Class 2b).
- Patients with SIHD and disease in the proximal LAD have an uncertain survival advantage with either CABG or PCI (section 7.1.7, Class 2b).
- Patients with refractory angina and significant CAD obtain relief of ischemic symptoms from revascularization (section 7.2.1, Class 1).
- Patients with SIHD and MV-CAD suitable for CABG or PCI are likely to have reduced cardiovascular events such as spontaneous myocardial infarction, repeat revascularization, or cardiac death after revascularization (section 7.3.1, Class 2a).

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**KEY WORDS** clinical practice guidelines, coronary artery bypass surgery, left main, left ventricular dysfunction, multivessel coronary artery disease, percutaneous coronary intervention

**APPENDIX** For supplemental videos, please see the online version of this paper.