CLINICAL PRACTICE

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Chronic Stable Angina

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This Journal *feature begins with a case vignette highlighting a common clinical problem. Evidence supporting various strategies is then presented, followed by a review of formal guidelines, when they exist. The article ends with the author's clinical recommendations.*

A 73-year-old farmer with a 15-month history of stable angina presents for consultation. He has curtailed his farming activity to avoid chest discomfort, for which he uses nitroglycerin (0.4 mg sublingually) approximately 3 times per month. His heart rate is 59 beats per minute, and his blood pressure is 132/72 mm Hg. He had unstable angina 12 years earlier, and a drug-eluting stent was implanted in his left anterior descending artery; no other obstructive coronary artery disease was noted at that time. His medications include aspirin, lisinopril (20 mg daily) for hypertension, and atorvastatin (40 mg daily). How should this case be evaluated and managed?

THE CLINICAL PROBLEM

CHRONIC STABLE ANGINA PECTORIS IS A COMMON MANIFESTATION OF coronary artery disease, which is the leading cause of death worldwide. An estimated 15.5 million American adults have chronic coronary artery disease, and more than 7 million have angina.[1] Angina is the initial manifestation in approximately half of all patients who present with coronary artery disease. The presence of chronic angina approximately doubles the risk of major cardiovascular events.[2,3] Studies with 1 to 9 years of follow-up data have shown that among patients with angina, factors associated with an increased risk of myocardial infarction or death include advanced age, severe forms of angina, coexisting illnesses (including chronic kidney disease and diabetes), abnormal heart function, and the inability to perform a stress test.[4-6] Patients with angina also have substantial rates of complications,[7] with associated increases in health care expenditures.[6]

Angina is traditionally defined as substernal chest discomfort (pain or tightness) of less than 10 minutes' duration. This discomfort is provoked by exertion or emotional stress and is relieved by rest or by administration of nitroglycerin. In this typical form, angina is suggestive of obstructive coronary artery disease,[8,9] but other common conditions such as anemia and valvular heart disease may mimic typical angina.[10] Angina may also be atypical, manifesting with less characteristic symptoms such as dyspnea or jaw pain; atypical presentations are more common among women and elderly persons than among men and younger persons. The severity of angina can be classified with the use of the Canadian Cardiovascular Society (CCS) scale (Table S1 in the Supplementary Appendix, available with the full text of this article at NEJM.org).[8,9]

STRATEGIES AND EVIDENCE

Establishing a diagnosis of chronic angina should be pursued in parallel with managing symptoms and initiating preventive therapies. Preventive therapies are

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> **KEY CLINICAL POINTS**
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> **CHRONIC STABLE ANGINA**
> - In patients with suspected angina, it is important not only to make a diagnosis, but also to assess the prognosis.
> - Management of angina should include lifestyle changes and pharmacotherapy to reduce cardiovascular risks, including those associated with high blood pressure and elevated lipid levels.
> - Standard antianginal medications include beta-blockers, long-acting nitrates, and calcium-channel blockers; ranolazine is a new agent approved by the Food and Drug Administration for angina.
> - Relief of angina should be assessed again within 2 weeks after the initiation of therapy.
> - An invasive strategy is a reasonable option in patients who do not have a response to medical therapy.
> - Physiological assessment of the target lesion is useful to guide decisions regarding revascularization.

warranted even without a firm diagnosis and should focus on blood-pressure control and cholesterol management. The recent Systolic Blood Pressure Intervention Trial (SPRINT) showed that the risk of the primary composite outcome (myocardial infarction, other acute coronary syndromes, stroke, heart failure, or death from cardiovascular causes) was 25% lower among participants who were assigned to a target systolic blood pressure of less than 120 mm Hg than among those who were assigned to a target systolic blood pressure of less than 140 mm Hg.[11]

Furthermore, a recent study suggests that addressing all risk factors (by encouraging smoking cessation and reducing non–high-density lipoprotein cholesterol, triglyceride, blood-pressure, and blood sugar levels) in patients who have diabetes and stable coronary artery disease is associated with reduced mortality.[12] This study highlights the importance of treating multiple risk factors adequately.

EVALUATION

The first step in the evaluation of chronic angina is to assess the likelihood of clinically significant coronary artery disease on the basis of the following factors: the character of the chest pain (typical, atypical, or nonanginal); the patient's age, sex, and smoking status; the presence of diabetes or hyperlipidemia; and Q-wave or ST-T wave changes on electrocardiography (ECG).[8,9] Severe angina, advanced age, female sex, smoking, coexisting illnesses, and abnormal heart function on ECG have been correlated with the presence of clinically significant coronary artery disease as assessed with the use of standard angiography.[13,14] More recent studies that use coronary computed tomographic angiography (CTA) suggest that prediction based on these risk factors, however, may substantially overestimate

the prevalence of coronary artery disease.[15] This discrepancy is not surprising, since the studies that established these pretest probability criteria were performed in an era of high smoking rates and limited prevention therapies.

Several tests that are used to diagnose coronary artery disease can also provide prognostic information (Table 1). The standard exercise ECG stress test is the least sensitive test for coronary artery disease and cannot define its extent, but the duration of exercise, presence of ST-segment changes, and occurrence of angina confer prognostic information.[16]

As compared with the routine exercise ECG stress test, stress tests that involve imaging typically have a superior ability to detect coronary artery disease without an appreciable loss of specificity.[9] The exercise ejection fraction is one of the most important prognostic variables in patients with coronary artery disease.[17] Imaging stress tests allow evaluation of left ventricular performance and assessment of the extent of ischemia during stress.

U.S. guidelines have recommended the use of the exercise ECG stress test as a first-line test, although in practice it is used infrequently.[8] A recent review article recommends the use of the exercise ECG stress test to detect coronary artery disease in low-risk patients (young patients with normal ECG findings and good exercise tolerance).[18] An inability to perform an exercise test is associated with a poor cardiac prognosis.[8,9] Pharmacologic stress testing with imaging is useful for determining the diagnosis and assessing the prognosis in patients who cannot exercise.[19]

CTA can also be used to evaluate patients with suspected coronary artery disease, and it can effectively rule out obstructive coronary artery disease, but it may overestimate the extent of this disease.[20,21] In a large randomized trial

Table 1. Tests to Diagnose and Assess the Prognosis of Clinically Significant Coronary Disease.*

Test	Sensitivity	Specificity	Provides Prognostic Information†	Considerations
	percent			
Exercise stress test				
ECG	45–50	85–90	Yes	Easy to perform; can be used only with normal baseline ECG findings
Echocardiography	80–85	80–88	Yes	Cannot be used in patients with left bundle-branch block or right bundle-branch block; interpretation may be limited in overweight patients
Nuclear test	73–92	63–87	Yes	Radiation exposure
Pharmacologic stress test				
Dobutamine				
Echocardiography	79–83	82–86	Yes	Limited to patients who cannot exercise; can induce arrhythmias
MRI	79–88	81–91	Yes	Limited use in overweight patients and those with metal implants; can induce arrhythmias
Adenosine				
Echocardiography	72–79	92–95	Yes	Cannot be used in patients with left bundle-branch block or right bundle-branch block; interpretation may be limited in overweight patients; can cause wheezing and heart block
Nuclear test	90–91	75–84	Yes	Radiation exposure; can cause wheezing and heart block
MRI	67–94	61–85	Yes	Limited use in overweight patients and those with metal implants; can cause wheezing and heart block
PET	81-–97	74–91	No	Limited availability; can cause wheezing and heart block

* Modified from Montalescot et al.[9] ECG denotes electrocardiography, MRI magnetic resonance imaging, and PET positron-emission tomography.
† Most tests evaluate the risk of death, myocardial infarction, or both to assess prognosis.

comparing CTA with functional testing (with the specific type of stress testing chosen by the provider) in patients with symptoms that suggested coronary artery disease,[22] the primary composite outcome (death, myocardial infarction, hospitalization for unstable angina, or a major procedural complication) occurred in 3.3% of the patients in the CTA group and in 3.0% of the patients in the functional-testing group during 25 months of follow-up (adjusted hazard ratio, 1.04; 95% confidence interval, 0.83 to 1.29). A secondary end point of a composite of the primary end point plus invasive angiography showing no obstructive coronary artery disease occurred in fewer patients in the CTA group than in the functional-testing group. However, overall radiation exposure was higher in the CTA group than in the functional-testing group because a third of the patients in the latter group had no exposure to radiation. These findings favor stress testing as the first diagnostic strategy, reserving CTA to rule out coronary artery disease when a false positive test is suspected.

MANAGEMENT

In patients in whom stable angina is suspected, preventive therapies, including aspirin, should be started immediately if they are not already in use.[8,9] A meta-analysis of primary-prevention trials showed that the rate of cardiovascular events was 18% lower among persons who took aspirin than among controls (P<0.001), owing predominantly to a 23% lower rate of myocardial infarction among those who took aspirin. However, aspirin did not have a significant effect on the rate of death from cardiovascular causes. Among patients who took aspirin, as compared with controls, the rates of intracranial bleeding (0.04% vs. 0.03%) and gastrointestinal bleeding (0.10% vs. 0.07%) were modestly higher, although these events were rare.[23]

Blood pressure should be reduced to below 120/85 mm Hg if possible,[11] and a moderate-to-high-intensity statin (that reduces low-density lipoprotein [LDL] cholesterol levels by >30% from pretreatment levels) should be used. Randomized, placebo-controlled trials have suggested that

high-intensity statins (that reduce LDL cholesterol levels by >50%) can reduce episodes of angina[24] and improve exercise tolerance[25] in patients with chronic angina who are already receiving antianginal therapy. Furthermore, a randomized trial comparing high-intensity statin therapy with percutaneous coronary intervention (PCI) in patients with stable coronary artery disease showed a lower rate of ischemic cardiac events among the patients who received atorvastatin therapy than among those who underwent PCI, although between-group differences did not meet prespecified criteria for statistical significance.[26]

Changes in lifestyle behaviors should also be recommended. These changes include weight loss in overweight or obese patients, dietary changes to reduce fat and sugar intake, and smoking cessation.[8,9]

Antianginal therapy should be initiated as soon as the diagnosis is suspected. The goal of therapy is to reduce angina symptoms and exercise-induced ischemia.[27] Sublingual nitrates should be prescribed to all patients with suspected angina, and patients should be instructed in how to use them and told to seek medical attention if symptoms are not relieved after they have used 3 such tablets. Long-term antianginal therapies should also be initiated, with attention to the patient's resting heart rate and blood pressure.[27] A suggested approach for the use of various types of antianginal therapies is shown in Figure 1.[27]

Standard Antianginal Therapies

In patients with stable angina, beta-blockers, calcium-channel blockers, and long-acting nitrates reduce angina similarly and appear to have a similar safety profile (except for short-acting calcium-channel blockers).[27-29] All these agents were approved before more formal evaluation of efficacy for angina was implemented by the Food and Drug Administration.[30]

The choice of initial standard antianginal therapy should be individualized, taking into account the desired physiological effect and any coexisting conditions and side effects in the patient.[27] Beta-blockers have been advocated as primary therapy for angina because of data indicating a reduction in mortality when they are used after myocardial infarction.[8] However, two observational studies showed no significant association between beta-blocker use and mortality among patients with chronic coronary artery disease, although a possible reduced risk of recurrent myocardial infarction was observed with beta-blocker use.[31,32]
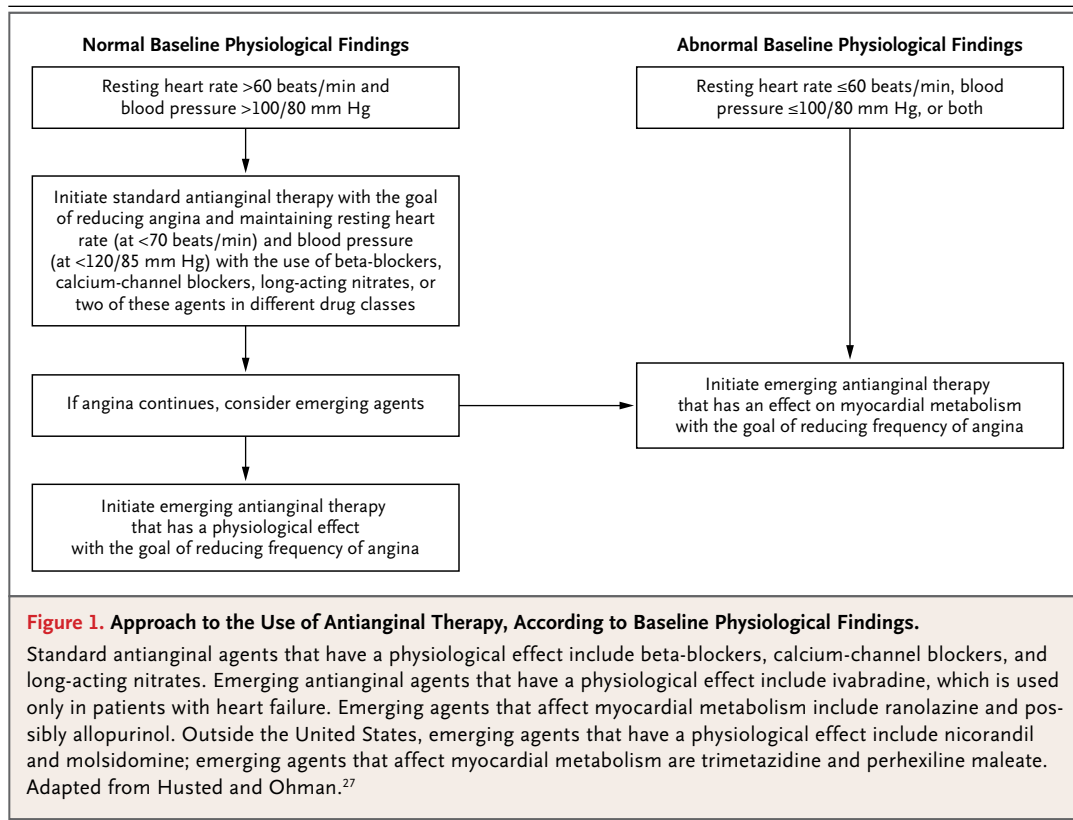
Guidelines have recommended that the most appropriate medical therapy for angina is a combination of two antianginal therapies in different drug classes (beta-blockers, calcium-channel blockers, or long-acting nitrates); this combination therapy has been recommended because of synergistic physiological effects (Table 2).[8,9] However, randomized trials have not shown that such combination therapy is more effective in reducing ischemia or angina symptoms than beta-blocker monotherapy.[27,33]

Doses of antianginal therapies should be increased, as needed, to achieve symptom control and improvements in heart rate and blood-pressure levels. If symptoms are not relieved within 2 weeks after the initiation of therapy, cardiac catheterization may be indicated.

Emerging Antianginal Therapies

Although all standard antianginal therapies have a physiological effect (i.e., they affect heart rate or blood pressure), three emerging therapies (i.e., therapies that are becoming more widely used) that have a physiological effect and four that have a direct effect on myocardial metabolism are also available worldwide.[7] Three of these therapies are available in the United States and are described below (Table 2).[27]

Ranolazine is a metabolic antianginal agent that is approved for the treatment of chronic angina. It diminishes myocardial ischemia by reducing calcium overload caused by inhibition of the late sodium current.[34] It does not affect heart rate or blood pressure[35] and thus may be considered as a first-line agent for patients with slow heart rate or low blood pressure. Among patients with stable angina who could perform an exercise ECG stress test, exercise duration was longer and angina episodes were fewer among patients who received ranolazine therapy than among those who received placebo, without the use of background therapy[36] or standard antianginal therapy.[37] It has been evaluated in two studies of outcomes in patients with angina, with mixed results. In a study involving patients who had diabetes and angina, the weekly frequency of angina was 12% lower over time with ranolazine than with placebo (P=0.008), and the

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Normal Baseline Physiological Findings

| Resting heart rate >60 beats/min and blood pressure >100/80 mm Hg |

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| Initiate standard antianginal therapy with the goal of reducing angina and maintaining resting heart rate (at <70 beats/min) and blood pressure (at <120/85 mm Hg) with the use of beta-blockers, calcium-channel blockers, long-acting nitrates, or two of these agents in different drug classes |

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| If angina continues, consider emerging agents |

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| Initiate emerging antianginal therapy that has a physiological effect with the goal of reducing frequency of angina |

Abnormal Baseline Physiological Findings

| Resting heart rate ≤60 beats/min, blood pressure ≤100/80 mm Hg, or both |

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| Initiate emerging antianginal therapy that has an effect on myocardial metabolism with the goal of reducing frequency of angina |

Figure 1. Approach to the Use of Antianginal Therapy, According to Baseline Physiological Findings.

Standard antianginal agents that have a physiological effect include beta-blockers, calcium-channel blockers, and long-acting nitrates. Emerging antianginal agents that have a physiological effect include ivabradine, which is used only in patients with heart failure. Emerging agents that affect myocardial metabolism include ranolazine and possibly allopurinol. Outside the United States, emerging agents that have a physiological effect include nicorandil and molsidomine; emerging agents that affect myocardial metabolism are trimetazidine and perhexiline maleate. Adapted from Husted and Ohman.[27]

use of nitrates was 19% lower with ranolazine than with placebo (P=0.003) during an 8-week period.[38] In a recent trial involving patients with chronic angina who had incomplete revascularization after PCI, ranolazine did not result in a significantly lower need for repeat revascularization or hospitalization for ischemia[39] or in fewer angina symptoms at 1 year.[40] Patients who received ranolazine were more likely than patients who received placebo to discontinue therapy, and the nonadherence rate (27% at 1 year) may have contributed to the lack of observed efficacy.

Side effects of ranolazine are dose-dependent and include dizziness (in 5% of patients who receive it), nausea (in 2%), and constipation (in 2%).[34] Ranolazine prolongs the QT interval in a dose-dependent manner[34]; however, no increase in significant arrhythmias has been observed with its use in multiple safety studies.[27] In a trial involving patients with non–ST-elevation acute coronary syndrome,[41] significant arrhythmias were less common in the ranolazine group than in the placebo group; these findings suggest that prolongation of the corrected QT (QTc) interval is not a safety concern. Still, caution is warranted

regarding prescription of other drugs that cause QT-interval prolongation, as well as regarding other drug–drug interactions (Table 2).

Ivabradine is a selective heart-rate–lowering (physiological) agent that inhibits the *If* current in the pacemaker cells in the sino-atrial node.[27] It is approved for treatment of heart failure with a goal of preventing hospitalization in patients who have an increased heart rate despite adequate beta-blocker therapy. It has also been reported to be effective in improving exercise duration in patients with chronic angina who are not receiving background therapy.[27,41] However, the results of a large randomized trial involving patients who had both stable coronary artery disease without heart failure and a resting heart rate of 70 beats per minute or more have aroused concern about the use of ivabradine for chronic angina.[42] In a prespecified subgroup of approximately 12,000 patients with chronic angina (class >II on the CCS scale, which ranges from I to IV, with higher classes indicating greater limitations on physical activity owing to angina), the rates of death and nonfatal myocardial infarction were higher among patients who received ivabra-

Table 2. Antianginal Agents.*

Agent	Common Side Effects	Contraindications	Potential Drug Interactions
Agents that have a physiological effect			
Short-acting and long-acting nitrates	Headache, flushing, hypotension, syncope and postural hypotension, reflex tachycardia, methemoglobinemia	Hypertrophic obstructive cardiomyopathy	Phosphodiesterase type 5 inhibitors (sildenafil and similar agents), alpha-adrenergic blockers, calcium-channel blockers
Beta-blockers	Fatigue, depression, bradycardia, heart block, bronchospasm, peripheral vasoconstriction, postural hypotension, impotence, masked signs of hypoglycemia	Low heart rate or heart conduction disorder, cardiogenic shock, asthma, severe peripheral vascular disease, decompensated heart failure, vasospastic angina; use with caution in patients with COPD (cardioselective beta-blockers may be used if patient receives adequate treatment with inhaled glucocorticoids and long-acting beta-agonists)	Heart-rate–lowering calcium-channel blockers, sinus-node or AV conduction depressors
Calcium-channel blockers			
Heart-rate–lowering agents	Bradycardia, heart conduction defect, low ejection fraction, constipation, gingival hyperplasia	Cardiogenic shock, severe aortic stenosis, obstructive cardiomyopathy	CYP3A4 substrates (digoxin, simvastatin, cyclosporine)
Dihydropyridine	Headache, ankle swelling, fatigue, flushing, reflex tachycardia	Low heart rate or heart rhythm disorder, sick sinus syndrome, congestive heart failure, low blood pressure	Agents with cardiodepressant effects (beta-blockers, flecainide), CYP3A4 substrates
Agent that affects myocardial metabolism			
Ranolazine	Dizziness, constipation, nausea, QT-interval prolongation	Liver cirrhosis	CYP3A4 substrates (digoxin, simvastatin, cyclosporine), drugs that prolong the corrected QT interval

* Modified from Husted and Ohman.[27] A full list of prescribing information is provided in the Food and Drug Administration–approved label of each agent. COPD denotes chronic obstructive pulmonary disease, and CYP3A4 cytochrome P-450 3A4.

dine than among those who received placebo (7.6% vs. 6.5%, P=0.02). Although no clear explanation was provided for these findings, ivabradine should not be used to treat angina in the absence of heart failure.[27]

Allopurinol, a xanthine oxidase inhibitor that is used to prevent gout, has also been proposed as an antianginal metabolic agent. Potential mechanisms include decreased demand for myocardial oxygen and improved vascular endothelial function.[27] In a study involving 65 patients with chronic angina, the time to ischemia with an exercise ECG stress test was longer among persons who received high-dose allopurinol than among those who received placebo.[43] Because of limited clinical data, U.S. guidelines do not recommend allopurinol for the treatment of angina,[8] but it is recommended in the European guidelines.[9]

Invasive Treatment Strategies
Although invasive angiography has become a very safe diagnostic procedure, particularly with radial access, serious complications occasionally occur.[44] Visual interpretation of the severity of the coronary lesions identified varies considerably,[45] and determination of severity by visual interpretation can lead to overdiagnosis and overtreatment. The decision about whether to perform angiography should therefore be separated from the decision about whether to revascularize.[46]

The measurement of fractional flow reserve, a hemodynamic assessment of the severity of a lesion by measurement of the pressure difference across a lesion in a patient with drug-induced hyperemia, is useful in defining the clinical significance of borderline lesions.[46] In randomized trials that involved the use of this test, clinical outcomes were better when only lesions with a

fractional flow reserve of 0.80 or less were treated with PCI than when treatment was based on visual assessment.[46,47] A patient-level meta-analysis of several randomized trials suggested that routine use of fractional flow reserve during diagnostic angiography could reduce the need for revascularization (predominantly PCI) by 50%, with a relative reduction of 20% in rates of death, myocardial infarction, and subsequent revascularization procedures.[47]

The decision regarding whether and how to revascularize (with PCI or coronary-artery by-pass grafting [CABG]) or whether to continue medical therapy should ideally involve a heart-team approach[8,9] incorporating input from inter-ventional cardiologists and cardiothoracic sur-geons. The decision should take into account clinical risk factors, characteristics of the lesion, and hemodynamic factors, and it may be informed by the use of validated risk scores to refine the selection of patients for PCI versus CABG.[46] In patients selected for revascularization, the goal should be complete revascularization if possible; patients with more extensive coronary disease derive more benefit from CABG.[46] Figure 2 shows an algorithm with associated recommen-dations by the American College of Cardiology and the American Heart Association, and by the European Society of Cardiology.[8,9,46]

Randomized trials involving patients who were eligible for either medical therapy or revas-cularization have shown that PCI is effective in reducing angina in patients with chronic angi-na,[46,48] but it does not result in a lower risk of death or myocardial infarction than that with medical therapy.[49] These observations suggest that medical therapy alone is a reasonable start-ing point if it has an acceptable side-effect pro-file. Revascularization should be considered for patients who have ongoing angina despite ade-quate medical therapy; this group includes as many as 50% of patients with chronic angina.[46] For patients who have angina and are treated medically without revascularization, referral to a structured cardiac rehabilitation program should be considered.[8]

AREAS OF UNCERTAINTY

Data from large randomized outcome trials in-volving patients with chronic angina are limited. The ongoing International Study of Comparative

Health Effectiveness with Medical and Invasive Approaches (ISCHEMIA; ClinicalTrials.gov num-ber, NCT01471522) is comparing conservative management (medical therapy without angiogra-phy) with invasive management (angiography and revascularization) in patients with chronic an-gina and at least moderate ischemia on stress testing.[50] There are few large randomized trials of medical therapies for chronic angina to in-form long-term safety and efficacy[27]; the role of allopurinol and other emerging antianginal ther-apies remains uncertain.

GUIDELINES

American and European guidelines have been published to guide the diagnosis and manage-ment of chronic angina.[8,9] Although these guide-lines share many common approaches, they differ in several ways. The European guidelines[9] are less prescriptive regarding the type of stress test to pursue, whereas U.S. guidelines[8] recom-mend an exercise ECG stress test as the first-line stress test. U.S. guidelines make specific recom-mendations regarding the survival benefit of CABG over PCI for extensive coronary disease, whereas European guidelines recommend PCI more broadly than do U.S. guidelines for chronic angina.[8,9,46]

CONCLUSIONS AND RECOMMENDATIONS

The patient described in the vignette has stable angina and known coronary artery disease. Since a long time has passed between his prior PCI and current stable symptoms, I would begin by prescribing antianginal therapy. I would not prescribe beta-blockers, given his slow resting heart rate. A long-acting nitrate would be a rea-sonable first-line therapy. Maintaining blood-pressure control with a higher dose of lisinopril and continued statin therapy is warranted. Stress testing is also warranted, since the extent and distribution of ischemia would guide further de-cision making. If there was ischemia in the proximal left anterior descending coronary artery distribution or reduced heart function, I would favor cardiac catheterization with consideration of revascularization, depending on the anatomi-cal features. Stress test results that show low risk are associated with a good prognosis and
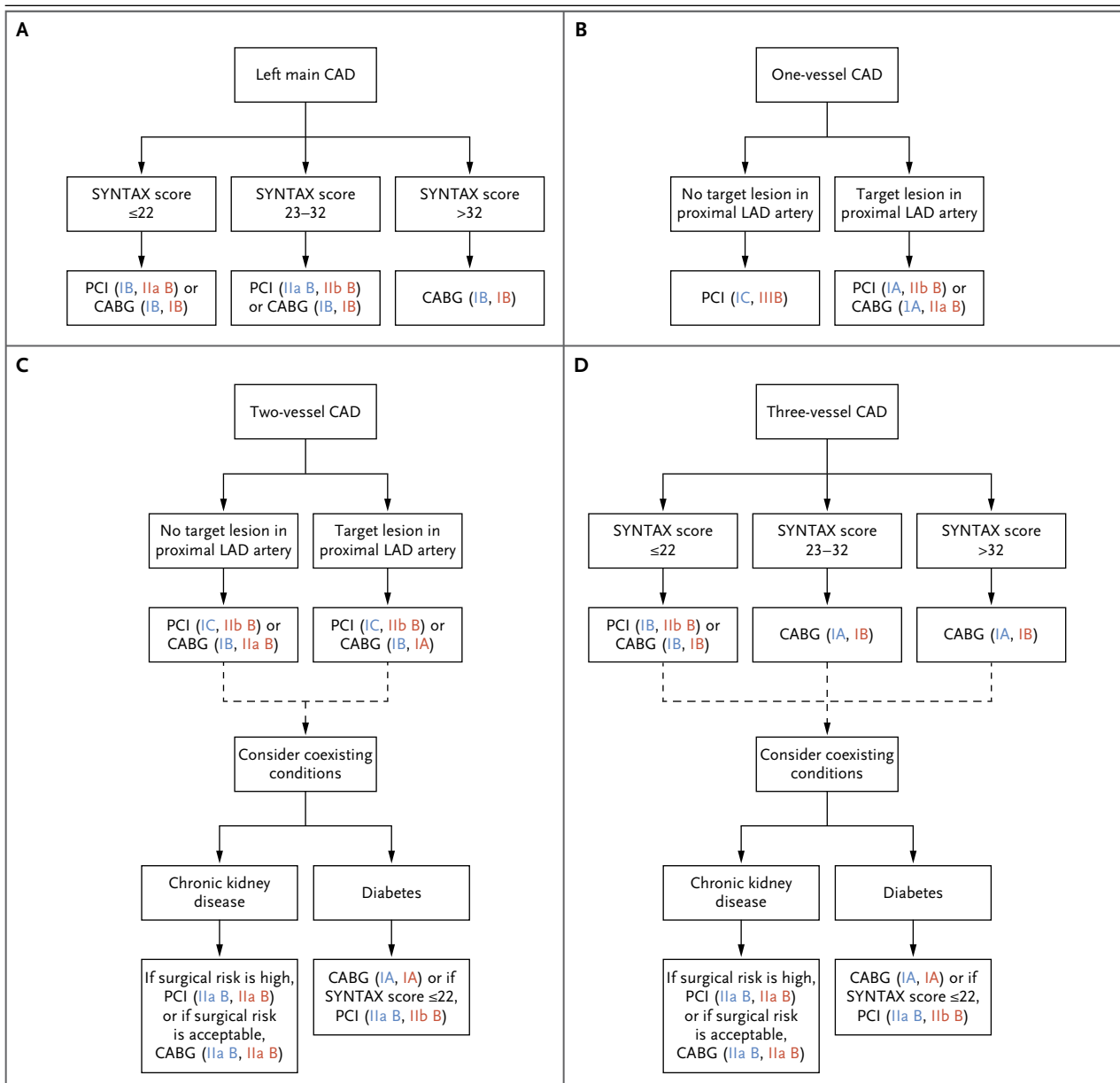
Figure 2. Algorithm for the Selection of a Revascularization Strategy.

Selection of a revascularization strategy is based on the presence of left main coronary artery disease (CAD) (Panel A), one-vessel CAD (Panel B), two-vessel CAD (Panel C), or three-vessel CAD (Panel D). In patients with two-vessel or three-vessel CAD, the coexisting conditions shown should also be considered. Class recommendations are based on the European Society of Cardiology[9] (blue) and the American College of Cardiology and the American Heart Association[8] (red) guidelines for revascularization. The European class recommendations shown are class IA; class IB; class IC; and class IIa, level of evidence B. The U.S. class recommendations shown are class IA; class IB; class IIa, level of evidence B; class IIb, level of evidence B; and class IIIB. The U.S. guidelines[8] have adopted two tiers for recommendations (symptomatic relief and survival benefit); the recommendations in this figure were simplified to reflect survival benefit. The Synergy between PCI with Taxus and Cardiac Surgery (SYNTAX) score is a validated angiographic score to guide decisions about revascularization for patients with multivessel coronary disease, according to estimated outcomes. Scores range from 0 to 83, with higher scores indicating more complex disease.[46] Adapted from Piccolo and colleagues.[46] CAD denotes coronary artery disease, CABG coronary-artery bypass grafting, LAD left anterior descending, and PCI percutaneous intervention.

would provide support for continued medical therapy.

If the patient continues to have angina with strenuous exertion (in a stress test that shows low risk) despite standard medical therapy, I would discuss with the patient the options of receiving additional antianginal therapy (e.g., a calcium-channel blocker or a metabolic agent [ranolazine]) (Fig. 2) or pursuing catheterization, with potential revascularization. Decisions should be guided by the patient's preferences. If catheterization is performed, the physiological characteristics of the lesion should be evaluated (by means of fractional flow reserve) to ensure that only clinically significant lesions are subjected to PCI; this approach has been shown to reduce the risk of periprocedural complications and improve clinical outcomes.

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