Decision Making in Revascularization: CABG or PCI?

Clinical Practice Today CME

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Learning Objective

Upon completion, participants should be able to:

- Incorporate individual risk information and other patient-specific factors into evidence-based revascularization decisions for patients with CAD

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Introduction

Both coronary artery bypass graft surgery (CABG) and percutaneous coronary intervention (PCI) have been established as effective methods for revascularization in patients with coronary artery disease (CAD).[1,2] In many instances, however, the optimal choice of treatment—CABG or PCI—is uncertain due to a variety of factors, including anatomic variables, patient comorbidities, cardiac function, and the extent of disease.[3] Additionally, questions remain about comparative long-term survival associated with these procedures.[4]

Revascularization Guideline Recommendations

In 2011, the American College of Cardiology Foundation/American Heart Association (ACCF/AHA) in conjunction with several other medical societies coordinated and updated the guidelines for both CABG and PCI in CAD to help promote a clinical consensus among medical and interventional cardiologists regarding the choice of revascularization strategy.[1,2,5]

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Revascularization Guideline Recommendations (cont.)

SYNTAX Score

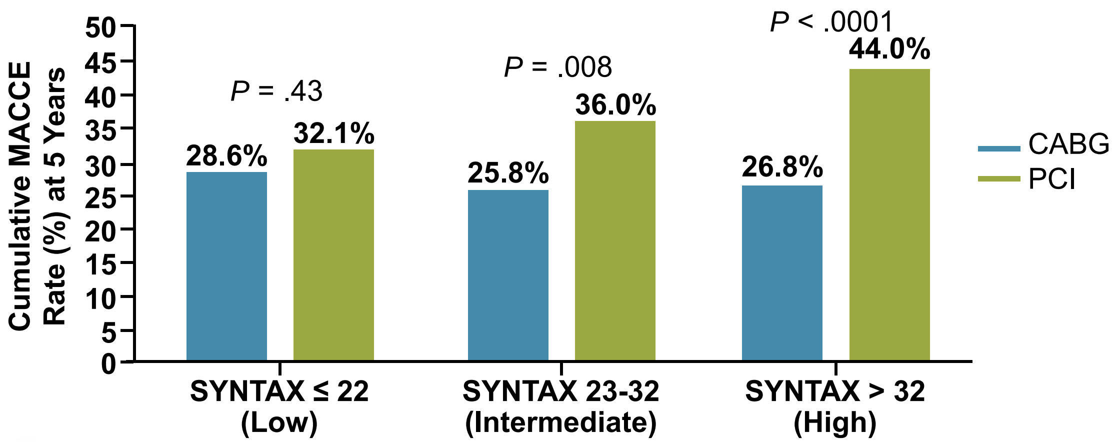
ACCF/AHA guidelines recommend using the SYNTAX (Synergy Between Percutaneous Coronary Intervention With Taxus and Cardiac Surgery) score as one factor in choosing a revascularization strategy for patients with CAD.[1,2] The SYNTAX score is a computer algorithm tool that was developed in connection with the 2009 SYNTAX trial, which was perhaps the most pivotal randomized study comparing PCI and CABG in severe CAD (discussed in detail later in this publication).[6,7] The SYNTAX tool's purpose was to characterize coronary vasculature from diagnostic angiograms in terms of the number of lesions and their location, complexity, and functional impact.[6] It is based on the AHA's coronary artery tree classification as modified by the Arterial Revascularization Therapies Study investigators and divides the coronary tree into 16 segments that are weighted according to relative blood flow supplied to the left ventricle.[8] A low score was defined as 22 or less, an intermediate score as 23 to 32, and a high score as 33 or more.[7] Higher SYNTAX scores are indicative of more complex

Revascularization Guideline Recommendations (cont.)

SYNTAX Score (cont.)

disease and a worse overall prognosis.[6] Based on results from the SYNTAX trial that continue to be validated in long-term follow-up analyses (Figure 1), CABG is generally recommended in patients with a SYNTAX score of 33 or more, whereas PCI may be considered in patients with low-to-intermediate scores when also considering other patient factors that may predict outcomes.[1,2]

Figure 1. SYNTAX Trial: 5-Year Outcomes (% MACCE) Based on SYNTAX Score



CABG = coronary artery bypass graft surgery; MACCE = major adverse cardiac or cerebrovascular events; PCI = percutaneous coronary intervention; SYNTAX = Synergy Between Percutaneous Coronary Intervention With Taxus and Cardiac Surgery.

Data derived from Mohr FW, Morice MC, Kappetein AP, et al. Coronary artery bypass graft surgery versus percutaneous coronary intervention in patients with three vessel disease and left main coronary disease: 5-year follow-up of the randomised, clinical SYNTAX trial. *Lancet*. 2013;381(9867):629-638.

Revascularization Guideline Recommendations (cont.)

SYNTAX Score (cont.)

When using the SYNTAX computer algorithm, clinicians answer 12 self-guided sequential questions regarding an individual patient's coronary vasculature.[6] Questions 1 to 3 determine the dominance, total number of lesions, and vessel segments involved per lesion. The remaining 9 questions refer to lesion characteristics, including total occlusion, trifurcation, bifurcation, aortoostial lesions, tortuosity, length, calcification, thrombi, and diffuse disease/small vessels.[6] The SYNTAX score working group offers an online tutorial available at www.syntaxscore.com.

The SYNTAX score is not without limitations. One drawback is that it has been validated as an independent predictor of adverse cardiovascular events in PCI-treated patients but not in patients undergoing CABG.[7] Another limiting factor is that patients may have angiographically "severe" lesions that are not physiologically important, and these findings may result in overtreatment and potentially worsened outcomes.[3,9] Additionally, the SYNTAX score does not account for nonanatomic patient factors, such as age or the presence of comorbidities, which may strongly influence decision making.[3]

Revascularization Guideline Recommendations (cont.)

SYNTAX Score (cont.)

To address these limitations, several investigators have developed alternate SYNTAX scores or have suggested combining the SYNTAX score with the results of other risk-assessment tools. For example, Nam et al developed the functional SYNTAX score (FSS), which integrates a fractional flow reserve measurement with angiography.[10] The FSS was validated in the FAME study (Fractional Flow Reserve Versus Angiography for Multi-vessel Evaluation) in which patients with angiographically severe but hemodynamically insignificant lesions were reclassified to lower risk levels. Trial results indicated that, compared with the conventional SYNTAX score, the FSS had better prognostic value and reproducibility and increased the proportion of patients with multivessel CAD who fell into the lowest-risk category for adverse events after PCI.[10] Similarly, Garg et al proposed an expanded “clinical SYNTAX score” that incorporates patient age, ejection fraction, and creatinine clearance and has been shown to be more effective than the original SYNTAX score in predicting MACCE after PCI during a 5-year follow-up.[11]

Revascularization Guideline Recommendations (cont.)

SYNTAX Score (cont.)

Additionally, EuroSCORE II is another tool developed to predict mortality outcomes after cardiac surgery that considers a wider range of patient-related factors, cardiac risk factors, and risk factors associated with surgery.[12] When combined with the SYNTAX score, EuroSCORE II appears to significantly improve prediction of cardiac mortality compared with the standalone SYNTAX score in patients undergoing PCI.[13] A EuroSCORE II interactive calculator is available at www.euroscore.org/calc.html.

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Revascularization Guideline Recommendations (cont.)

Improving Survival

Table 1 summarizes the 2011 ACCF/AHA guideline recommendations for CABG and PCI to improve survival. CABG is the gold standard for the treatment of unprotected left main coronary artery stenosis that is 50% or greater.[1] In general, PCI is considered to be a reasonable alternative to CABG in patients with left main CAD and intermediate-to-lower SYNTAX scores who have a low risk of PCI procedural complications and a significantly increased risk of adverse surgical outcomes with CABG.[1,2]

Table 1. ACCF/AHA Guidelines for Revascularization With CABG or PCI for Improving Survival

Unprotected Left Main CAD With ≥ 50% Stenosis	
CABG Use (Class/LOE)[a]	**PCI Use (Class/LOE)**
Recommended (IB)	• For stable ischemic heart disease: if low risk of procedural complications/good prognosis for long-term outcomes (eg, ostial or trunk left main CAD, SYNTAX score ≤ 22) **and** significant risk of adverse surgical outcomes (IIaB) • For UA/NSTEMI: if not a candidate for CABG (IIaB) • For STEMI: when TIMI flow grade < 3 and PCI can be performed more rapidly and safely than CABG (IIaC) • For stable ischemic heart disease: when there is a low-to-intermediate risk of procedural complications and an intermediate-to-high likelihood of good long-term outcome (eg, SYNTAX score < 33, bifurcation left main CAD) **and** an increased risk of adverse outcomes due to clinical characteristics/comorbidities (IIbB)

[a]Level of evidence: A = multiple populations evaluated, data derived from multiple randomized clinical trials or meta-analyses; B = limited populations evaluated, data derived from a single randomized trial or nonrandomized studies; C = very limited populations evaluated, only consensus opinion of experts, case studies, or standard of care. Data available from clinical trials or registries about the usefulness/efficacy in different subpopulations, such as sex, age, history of diabetes, history of prior myocardial infarction, history of heart failure, and prior aspirin use. Recommendations: class I (benefit >>> risk), class IIa (benefit >> risk), class IIb (benefit ≥ risk).

CABG = coronary artery bypass surgery; CAD = coronary artery disease; FFR = fractional flow reserve; LAD = left anterior descending; LOE = level of evidence; LIMA = left internal mammary artery; PCI = percutaneous coronary intervention; SYNTAX = Synergy Between Percutaneous Coronary Intervention With Taxus and Cardiac Surgery; TIMI = Thrombolysis in Myocardial Infarction; UA/NSTEMI = unstable angina/non-ST-elevation myocardial infarction.

Revascularization Guideline Recommendations (cont.)

Improving Survival (cont.)

Lesion site is a crucial factor when considering PCI for unprotected left main CAD.[5] For example, treating distal bifurcation or trifurcation stenosis is more complex and is associated with a greater risk of restenosis compared with stenting of the left main ostium or trunk.[5] PCI should not be performed to improve survival in stable patients with significant stenosis who have unfavorable anatomy for PCI or who are good candidates for CABG.[1]

Revascularization Guideline Recommendations (cont.)

Improving Survival (cont.)

In non–left main CAD revascularization, the ACCF/AHA guidelines recommend that CABG be performed to improve survival in patients with a diameter stenosis of at least 70% in three major coronary arteries (with or without the proximal left anterior descending [LAD] artery) or in the proximal LAD artery plus one other major coronary artery.[1] CABG may also be indicated in patients with non–left main CAD in other scenarios (Table 1) and in patients with a SYNTAX score of more than 22 if they are good surgical candidates.

Table 1. ACCF/AHA Guidelines for Revascularization With CABG or PCI for Improving Survival (cont.)

Significant Anatomic (≥ 70% Diameter Non–Left Main CAD) or Physiologic (FFR ≤ 0.80) Non–Left Main Coronary Artery Stenosis	
CABG Use (Class/LOE)	**PCI Use (Class/LOE)**
In 3-vessel disease with or without proximal LAD artery disease: • Recommended (IB) • Preferred to PCI in patients with SYNTAX score > 22, who are good candidates for CABG (IIaB)	In 3-vessel disease with or without proximal LAD artery disease: • Of uncertain benefit (IIbB)
In 2-vessel disease with proximal LAD artery disease: • Recommended (IB)	In 2-vessel disease with proximal LAD artery disease: • Of uncertain benefit (IIbB)
In 2-vessel disease without proximal LAD artery disease: • Recommended if there is extensive ischemia (IIaB) but of uncertain benefit without extensive ischemia (IIbC)	In 2-vessel disease without proximal LAD artery disease: • Of uncertain benefit (IIbB)
In 1-vessel proximal LAD artery disease: • With LIMA for long-term benefit (IIaB)	In 1-vessel proximal LAD artery disease: • Of uncertain benefit (IIbB)

Revascularization Guideline Recommendations (cont.)

Improving Symptoms (cont.)

CABG and PCI may be indicated to improve symptoms in certain patients with significant coronary artery stenosis and continuing angina despite guideline-directed medical therapy (GDMT).[1,2] CABG and PCI are also reasonable options for improving symptoms in patients for whom GDMT is contraindicated or in patients who would prefer an invasive approach. Choosing CABG over PCI for symptom relief in patients with a SYNTAX score of 22 or more with or without involvement of the proximal LAD artery is also reasonable, as long as they are good candidates for surgery. PCI may be considered in patients who have undergone a previous CABG, have significant coronary artery stenosis with ischemia, or have unacceptable angina despite GDMT. CABG can be used to improve symptoms in patients who have had a previous CABG but with significant carotid artery stenosis or symptoms despite GDMT.

Neither CABG nor PCI should be performed to improve symptoms in patients who do not meet physiologic or anatomic criteria for revascularization. PCI with coronary stenting of any type should not be performed in patients who cannot comply with or tolerate the recommended dual antiplatelet therapy.[1,2]

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Revascularization Guideline Recommendations (cont.)

Multidisciplinary Team Approach

The 2011 ACCF/AHA guidelines endorse a “Heart Team” approach in patients with CAD, particularly when the choice of revascularization strategy is uncertain.[1,2] This protocol is based on multidisciplinary teams used in randomized controlled trials. In these trials, patients with complex CAD who were referred specifically for either PCI or CABG had lower mortality rates than patients who were randomly assigned to a procedure.[1] The Heart Team includes an interventional cardiologist, a cardiac surgeon, and often a general cardiologist, who together[1]:

- Review the patient’s medical condition, coronary anatomy, risk-assessment scores, and relevant clinical factors
- Determine whether CABG and/or PCI is feasible and reasonable
- Discuss options for revascularization with the patient before implementing a treatment strategy

When revascularization choices are uncertain, the involved cardiologists, surgeons, and patient should discuss CABG and PCI immediately after diagnostic coronary angiography.[1]

The Comparative Effectiveness of Revascularization Strategies

Some of the uncertainty regarding choosing a revascularization strategy in patients with CAD is due to the lack of available data or conflicting data from randomized clinical trials. For example[14-16]:

- Many randomized trials comparing the effectiveness of CABG versus PCI in patients with CAD were conducted before the advent of drug-eluting stents (DES), including the newer sirolimus-, everolimus-, or zotarolimus-coated stents
- Some randomized trials have frequently enrolled patients who are not representative of those who would benefit from the procedures or those who are typically encountered in clinical practice
- Many randomized trials comparing CABG and PCI for multivessel CAD have been underpowered to sufficiently detect differences in mortality[15]

Despite the limitations inherent in the current literature, recent studies—primarily meta-analyses and observational studies from registry data—have shed some light on this issue.

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The Comparative Effectiveness of Revascularization Strategies (cont.)

In the 2009 SYNTAX trial, investigators randomized 1,800 patients with left main CAD or 3-vessel disease to undergo CABG or PCI. A key difference in this study compared with previous randomized trials is that both a cardiac surgeon and an interventional cardiologist independently determined that either procedure could achieve equivalent anatomic revascularization in individual patients. (Patients who would clearly benefit from one procedure over another were entered into a nested PCI or CABG registry.[7]) The primary endpoint was a MACCE during a 12-month follow-up. At 12 months, rates of MACCE were significantly higher in the PCI group than in the CABG group (17.8% vs 12.4%; $P = .002$), primarily because of an increased rate of repeat revascularization ($P < .001$). However, rates of death and myocardial infarction (MI) were similar between the two groups, although significantly more incidences of stroke were reported in the CABG group ($P = .003$). A major limitation of the initial SYNTAX trial was its relatively brief follow-up period.[7] However, results of a 5-year follow-up were recently published. Patients with intermediate-to-high SYNTAX scores had significantly increased rates of MACCE with PCI compared with CABG ($P < .0001$), whereas no significant difference in MACCE rates was observed in patients with lower risk scores (Figure 1).[17]

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The Comparative Effectiveness of Revascularization Strategies (cont.)

Meta-analyses have attempted to compare long-term mortality outcomes in CABG and PCI. A 2009 collaborative analysis of 10 randomized trials comparing CABG (N = 3,889) and PCI (N = 3,923) found that mortality was similar for the two procedures among most patient subgroups with multivessel CAD, with 15% and 16% dying in the CABG and PCI groups, respectively (HR, 0.91; 95% CI, 0.82-1.02; $P = .12$) over a median follow-up period of 5.9 years.[18] (Patients with diabetes or those 65 years or older had better long-term outcomes with CABG.[18]) A 2014 meta-analysis of six randomized clinical trials published between 2005 and 2012 that collectively enrolled 6,055 patients with multivessel CAD found a significant reduction in total mortality (RR, 0.73; 95% CI, 0.62-0.86; $P < .001$), MI (RR, 0.58; 95% CI, 0.48-0.72; $P < .001$), and repeat revascularization with CABG versus PCI (RR, 0.29; 95% CI, 0.21-0.41; $P < .001$) over an average follow-up of 4.1 years.[15] Researchers found a nonsignificant trend toward excess strokes with CABG, reflecting the findings of observational studies.[15]

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The Comparative Effectiveness of Revascularization Strategies (cont.)

Questions also remain as to whether PCI with DES—rather than the older balloon angioplasty or bare-metal stent (BMS) techniques—may offer improved outcomes after revascularization. Lee et al compared outcomes of PCI with DES and CABG in a 2010 meta-analysis of eight clinical trials that collectively enrolled 2,905 patients; two of the trials were randomized.[19] All patients had unprotected left main CAD, and the primary endpoints were the composite of death, MI, or stroke, along with target vessel revascularization at a 1-year follow-up. At 1 year, no significant difference was observed between the CABG and DES groups in the risk of death (OR, 1.12; 95% CI, 0.80-1.56) or the composite endpoint of death, MI, or stroke (OR, 1.25; 95% CI, 0.86-1.82). The risk of target vessel revascularization was significantly lower in the CABG group versus the PCI group (OR, 0.44; 95% CI, 0.32-0.59).[19]

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The Comparative Effectiveness of Revascularization Strategies (cont.)

Results from a group of observational studies published between 2006 and 2010 comparing CABG and PCI generally suggest that PCI for left main CAD is comparable to CABG in terms of mortality outcomes.[20] In these studies, however, CABG was associated with significantly more adverse early outcomes, such as death, primarily due to in-hospital or early MI. CABG was also associated with a comparative increased risk of stroke in these studies. Additionally, patients who underwent CABG experienced more postoperative complications and longer hospital stays, but repeat revascularization rates were higher for those who underwent PCI.[20]

Thus, current evidence suggests that PCI and CABG outcomes in patients with relatively uncomplicated and less severe CAD are comparable. However, CABG carries an increased risk of postoperative complications and stroke, whereas PCI is associated with an increased risk of repeat revascularization and may be associated with a short-term increased risk of MI.[5,15] CABG, on the other hand, appears to confer a long-term survival advantage in patients with more complex CAD.[17]

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Special Patient Populations

Listed below and on the following screens are several groups of patients who may require special consideration when making decisions about revascularization strategies. This list is not exhaustive, but is meant to provide examples of groups of patients for whom the decision to revascularize may be complicated by other factors.

Older Patients

Some studies have found improved long-term survival in older adults who undergo CABG versus PCI. A 2009 analysis reviewed individual patient data from 10 randomized trials to compare the effectiveness of CABG with PCI in multivessel CAD according to baseline clinical characteristics, such as age.[18] Researchers found that CABG resulted in a significantly lower mortality rate over a median follow-up period of 5.9 years. Even after adjustment for sex, diabetes, smoking, hypertension, 3-vessel disease, and a history of MI, this association of age and revascularization strategy remained significant (P = .002). The hazard ratio for mortality with CABG was 0.82 in patients 65 years and older compared with 1.25 in those younger than 55 and 0.9 in patients aged 55 to 64.[18] The 2012 ASCERT

Special Patient Populations (cont.)

Older Patients (cont.)

observational study (ACCF and Society of Thoracic Surgeons Database Collaboration on the Comparative Effectiveness of Revascularization Strategies) of patients 65 years or older with 2- or 3-vessel CAD found no significant difference in the adjusted mortality rate between the two procedures at 1-year post-procedure, but a significantly lower mortality rate in the CABG group was observed (RR, 0.79; 95% CI, 0.76-0.82) at a 4-year follow-up when compared with PCI.[21]

Special Patient Populations (cont.)

Older Patients (cont.)

Overall, older individuals have increased risks of complications during and in the immediate recovery period after any revascularization procedure, including major bleeding, stroke, and delayed recovery.[3] In addition, they are more likely to have comorbidities that increase perioperative risk, such as hypertension, a history of prior MI, previous CABG, diabetes, renal failure, and cognitive impairment. When selecting a revascularization strategy, such factors must be considered in conjunction with other risk-stratification tools, like the SYNTAX score. For example, in patients with cognitive impairment or those who have a high risk of stroke, clinicians may choose PCI over CABG despite a high SYNTAX score or choose novel surgical techniques that may be more suitable for these higher-risk patients, such as off-pump CABG.[3]

Special Patient Populations (cont.)

Patients With Diabetes

The 2012 FREEDOM trial (Future Revascularization Evaluation in Patients With Diabetes Mellitus: Optimal Management of Multivessel Disease) was the first large trial to compare CABG and PCI in patients with both multivessel CAD and diabetes (N = 1,900).[22] Findings indicated that revascularization with CABG resulted in lower rates of the primary composite outcome of death, MI, and stroke over a 5-year follow-up period when compared with PCI with DES (18.7% vs 26.6%, respectively; $P = .005$). This outcome was driven by a highly significant reduction in MI in the CABG arm (6.0% vs 13.9%; $P < .001$). Patients in the PCI arm, however, had fewer strokes (2.4% vs 5.2%; $P = .03$). The trial was not adequately powered to assess all-cause mortality, but investigators noted a trend toward reduced all-cause mortality in patients who were treated with CABG versus PCI ($P = .049$).[22]

Special Patient Populations (cont.)

Patients With Diabetes (cont.)

Since the publication of the FREEDOM trial, results of several other trials examining this issue have also become available, but they are generally underpowered or have short-term follow-ups.[23] To better assess all-cause mortality in revascularization in patients with diabetes and multivessel CAD, a 2013 meta-analysis analyzed available data from randomized controlled trials comparing CABG with PCI in this patient group. Of the eight trials included in the analysis, four used BMS and four used DES in the PCI arms. At a median or mean follow-up of 5 years, CABG decreased the long-term all-cause mortality by approximately 33% compared with BMS or DES in patients with diabetes (RR, 0.67; 95% CI, 0.52-0.86; *P* = .002). No differences in outcomes between the two methods were found in patients without diabetes, and the type of stent (BMS or DES) did not influence outcomes. Investigators concluded that CABG should be strongly considered for revascularization in patients with diabetes.[23] The 2011 ACCF/AHA guidelines, which were published before the FREEDOM trial and this meta-analysis, state that, in general, CABG is the preferred method of revascularization in patients with diabetes.[1]

Special Patient Populations (cont.)

Previous CABG

Patients who have undergone CABG may have incomplete revascularization or may experience graft failure and progression of native coronary artery narrowing.[24,25] These outcomes may lead to the need for repeat revascularization with either CABG or PCI.[24] However, data comparing the effectiveness and safety of reoperative CABG and PCI are limited. A 2013 study by Harskamp et al evaluated clinical outcomes in consecutive patients (N = 287) with graft failure assigned to reoperative CABG (n = 44) or PCI (n = 243).[25] The primary composite endpoint with a 5-year follow-up (median follow-up of 3.9 years) was death, MI, or target vessel revascularization and was similar at 5 years for both reoperative CABG and PCI (51.0% and 57.6%, respectively; *P* = .51), revealing that outcomes are equally poor in both groups. However, rates of periprocedural MI were lower following PCI (8.2% vs 20.5%; *P* = .01). Creatinine and peak creatinine kinase MB were independent predictors for primary outcomes in both groups; predictors for mortality alone included these two factors, as well as age.[25]

Special Patient Populations (cont.)

Previous CABG (cont.)

ACCF/AHA guidelines indicate that repeat revascularization is most likely to improve survival in patients at highest risk, such as those with extensive anterior ischemia and proximal LAD artery obstruction.[1] If ischemia occurs in other locations and a patent LIMA for the LAD artery exists, survival benefit from repeat revascularization is unlikely.[1]

The choice of procedure in patients requiring reoperative revascularization depends on a number of critical factors that must be evaluated, including[3,25]:

- Vascular and graft anatomy/pathology
- The number of diseased vessels and/or bypass grafts
- The availability of the internal mammary artery for a LIMA graft
- The availability of distal targets for the reoperative graft placement or PCI
- Patient characteristics, such as advanced age, diabetes, renal disease, and left ventricular function

Special Patient Populations (cont.)

STEMI

In patients with STEMI, primary PCI is the preferred method of reperfusion as long as ischemic symptoms last less than 12 hours.[26] PCI is also a reasonable reperfusion strategy if clinical or electrocardiogram evidence of ongoing ischemia is observed up to 24 hours after symptom onset. Primary PCI is also appropriate in patients who are eligible for fibrinolytic therapy but have contraindications to its use.[26]

With the development of PCI and fibrinolytic therapy, CABG is rarely used in patients with ST-segment elevation MI (STEMI).[3] However, ACCF/AHA guidelines indicate that urgent CABG is a reasonable choice in patients with STEMI who have coronary anatomy not amenable to PCI and who are in cardiogenic shock, have severe heart failure and ongoing or recurrent ischemia, or have other factors that put patients at high risk.[26] The benefits of CABG are currently uncertain in patients with failed PCI or refractory symptoms after PCI.[3] More studies are needed to evaluate the potential role of urgent CABG in these situations.[3]

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Special Patient Populations (cont.)

Chronic Kidney Disease

Chronic kidney disease (CKD) is extremely common, with an estimated 13% of the United States population affected by the condition.[27] Diabetes and hypertension are the two major causes of CKD. However, CKD is also independently associated with an increased risk of cardiovascular-related morbidity and mortality—50% to 60% of all deaths in patients with CKD before end-stage renal disease (ESRD) are due to cardiovascular disease.[27] The risk of such events is more pronounced in patients with ESRD.[28] Among patients receiving hemodialysis, 12% suffer an acute MI within the first 1.5 to 2 years and, by 3 years, 38% die suddenly, usually of cardiovascular causes.[28]

A large retrospective study (N = 4,584) evaluating revascularization strategies found that CABG was associated with improved survival compared with PCI or medical management in patients with CKD.[29] Compared with medical management, PCI correlated with a survival benefit among patients with normal, mildly impaired, and moderately impaired renal function but not among patients with severe CKD. In severe CKD, CABG was associated with greater mortality reduction than PCI.[29]

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Special Patient Populations (cont.)

Chronic Kidney Disease (cont.)

In studies of patients with CKD who are not dependent on dialysis and who undergo CABG, decreasing preoperative glomerular filtration rates (GFRs) have been found to be a predictor of poor postoperative outcomes, primarily acute renal failure.[28,30] The perioperative risk of adverse sequelae, including death, also increases as GFR decreases.[28,31] However, the use of internal mammary artery grafts in non–dialysis-dependent patients with a GFR of less than 30 mL/min/1.73 m^2 has been shown to significantly decrease the risk of operative death when compared with the use of venous grafts (OR, 2.7 vs 4.2).[28,31] Studies have also shown a significant benefit to using internal mammary artery grafts in patients with ESRD.[31]

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Special Patient Populations (cont.)

Chronic Kidney Disease (cont.)

Off-pump CABG appears to have several advantages in patients with CKD when compared with conventional on-pump CABG.[1,32] With off-pump CABG, patients with non–hemodialysis-dependent CKD have shorter postoperative intensive care unit stays, fewer bleeding complications, shorter postoperative mechanical ventilation times, and less perioperative fluid shifts.[32] ACCF/AHA guidelines suggest that off-pump CABG is a reasonable alternative to conventional CABG in patients with renal dysfunction.[1]

Despite perioperative risks, the use of CABG to improve survival or relieve angina that does not resolve with GDMT may be a reasonable option for patients with ESRD and stenosis of at least 70% in three major vessels or in the proximal LAD artery plus one other major vessel.[1] If life expectancy is limited by noncardiac comorbidities, however, revascularization with either CABG or PCI is likely to be inappropriate.[1]

Conclusion

Choosing the most appropriate revascularization strategy in CAD remains a topic of debate. However, recently coordinated guidelines for CABG and PCI, the incorporation of the SYNTAX score, and the implementation of a Heart Team approach represent important steps in decision making. Recently published data examining the comparative outcomes of CABG and PCI in special patient populations have also helped to clarify optimal choices for the elderly, patients with diabetes, and patients with CKD. Nevertheless, clinical assessment and judgment continue to be important aspects of care in many patients requiring revascularization.

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