Coronary artery bypass grafting and percutaneous coronary intervention in coronary artery disease: evidence and guidance

Derivación coronaria e intervención coronaria percutánea en enfermedad arterial coronaria: evidencia y recomendaciones

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Abstract

Coronary artery disease (CAD) remains a leading cause of acute myocardial infarction, heart failure, and premature mortality despite advances in prevention and pharmacologic therapy. Revascularization is fundamental for subjects with anatomically significant CAD, particularly those with refractory symptoms or a high risk of adverse outcomes, and it relies on two principal strategies: coronary artery bypass grafting (CABG) and percutaneous coronary intervention (PCI). Within this context, this narrative review aims to clarify how current scientific evidence and the most recent clinical practice guidelines inform the choice between these therapeutic options in clinical settings. To that end, the review examines the pathophysiologic foundations of CAD, its major risk factors, and the indications for revascularization. It then synthesizes key comparative considerations between CABG and PCI, including prevention of cardiovascular events, recovery trajectories, and the likelihood of achieving complete revascularization. Clinical modifiers that influence decision making are analyzed, such as diabetes, patient age, and the anatomical complexity of coronary lesions. In addition, the review outlines technological advances that characterize modern PCI and summarizes fundamental principles for graft selection in CABG. The overall goal is to provide a practical reference framework, centered on multidisciplinary teamwork and shared decision making, that enables optimization of the revascularization strategy in alignment with individual clinical objectives and patient preferences.

Keywords: Coronary artery disease, coronary artery bypass, percutaneous coronary intervention.

Resumen

La enfermedad arterial coronaria (EAC) sigue siendo una causa principal de infarto agudo de miocardio, insuficiencia cardiaca y mortalidad prematura, a pesar de los avances en prevención y terapias farmacológicas. La revascularización es fundamental en sujetos con EAC anatómicamente significativa, particularmente en aquellos con síntomas refractarios o alto riesgo de desenlaces adversos, sustentándose en dos estrategias principales: la cirugía de revascularización coronaria mediante bypass aortocoronario (CABG) y la intervención coronaria percutánea (PCI). En este contexto, esta revisión narrativa tiene como objetivo esclarecer cómo la evidencia científica actual y las guías clínicas más recientes orientan la elección entre dichas opciones terapéuticas en la práctica asistencial. Para ello, se examinan los fundamentos fisiopatológicos de la EAC, sus principales factores de riesgo y las indicaciones de revascularización. Posteriormente, se sintetizan consideraciones comparativas entre CABG y PCI, que incluyen la prevención de eventos cardiovasculares, las trayectorias de recuperación y la probabilidad de alcanzar una revascularización completa. Se analizan modificadores clínicos que influyen en la toma de decisiones, como la diabetes, la edad del paciente y la complejidad anatómica de las lesiones coronarias. Además, la revisión describe avances tecnológicos que caracterizan la PCI moderna y resume principios fundamentales para la selección de injertos en CABG. El objetivo global es proporcionar un marco de referencia práctico, centrado en el trabajo en equipo multidisciplinario y la toma de decisiones compartida, que permita optimizar la estrategia de revascularización en consonancia con los objetivos

clínicos individuales y las preferencias del paciente.

Palabras clave: Enfermedad arterial coronaria; Derivación coronaria; Intervención coronaria percutánea.

Introduction

Coronary artery disease (CAD) remains the leading global cause of cardiovascular morbidity and mortality, encompassing clinical events such as myocardial infarction, heart failure, and sudden cardiac death. Its population impact is driven by highly prevalent risk factors, including hypertension, dyslipidemia, diabetes, smoking, and obesity, and its prevalence remains substantial despite advances in prevention and pharmacotherapy[1,2]. Accordingly, strategies that reduce ischemic burden and prevent downstream events continue to be a central objective of contemporary cardiovascular care, with an emphasis on early detection, comprehensive risk-factor modification, and timely use of evidence-based interventions[3].

Revascularization occupies a pivotal role for subjects with anatomically significant CAD, particularly those with refractory symptoms or elevated risk of adverse outcomes. Coronary artery bypass grafting (CABG) and percutaneous coronary intervention (PCI) represent the principal invasive approaches. Current guidance from the American College of Cardiology and the American Heart Association recommends CABG to improve survival in left main disease, in multivessel disease with severe left ventricular dysfunction, and in anatomies in which complete and durable revascularization is more probable with surgery, whereas PCI is reasonable in less complex anatomy or when surgical risk is high[4,5]. In comparative terms, both strategies reduce spontaneous myocardial infarction and urgent revascularization, and both improve quality of life and angina control when contrasted with medical therapy alone, which supports an interventional approach in appropriately selected patients and underscores the value of integrating revascularization with guideline-directed medical therapy[6,7].

The choice between CABG and PCI should reflect coronary anatomy, ischemic burden, comorbidity profile, procedural risk, and patient-centered goals. A multidisciplinary Heart Team process facilitates consistent appraisal of anatomical complexity, the likelihood of complete revascularization, and the balance between perioperative risks and long-term durability, while also incorporating patient preferences and quality-of-life considerations[8,9]. Within this framework, the present review synthesizes contemporary evidence comparing CABG and PCI across common clinical scenarios, interpret this evidence in the context of current guidelines, with the goal of improving survival, reducing ischemic events, and enhancing health-related quality of life in CAD.

CORONARY ARTERY DISEASE AND REVASCULARIZATION STRATEGIES

CAD is the atherosclerotic narrowing of the epicardial coronary arteries that reduces myocardial blood flow, creates an imbalance between oxygen supply and demand, and presents clinically as angina, myocardial infarction, or sudden cardiac death[10]. Although obstructive plaques are the predominant substrate, ischemia may also arise from microvascular dysfunction or coronary vasospasm in the absence of flow-limiting stenoses, with downstream electrical, metabolic, and contractile impairment of the myocardium[11,12]. Risk increases with the cumulative burden of dyslipidemia, hypertension, diabetes mellitus, smoking, advanced age, obesity, sedentary behavior, and family history, with particular relevance in women and in individuals with chronic kidney disease[13]. Disease progression reflects plaque evolution, instability, and thrombosis that precipitate acute coronary syndromes, whereas stabilization or regression can occur through lifestyle modification, optimal pharmacotherapy, and rigorous risk-factor control[14]. Contemporary guidance supports revascularization to relieve symptoms in patients with limiting angina despite optimal medical therapy and anatomically suitable lesions, to improve survival in left main disease or multivessel disease with severe left ventricular dysfunction, and in selected multivessel disease to reduce spontaneous infarction and cardiac death[15,16].

Among revascularization strategies for anatomically significant CAD, the principal options are CABG and PCI. CABG restores myocardial perfusion by constructing conduits from the aorta to coronary targets distal to obstructive lesions, typically via median sternotomy that enables comprehensive assessment and anastomosis planning based on preoperative angiography and intraoperative inspection[17]. This strategy can be performed with cardiopulmonary bypass and cardioplegic arrest, on the beating heart without bypass to avoid extracorporeal circulation, or as a beating-heart procedure on pump in selected scenarios such as a diseased ascending aorta[18]. Conduit selection is pivotal: the left internal mammary artery is standard because of superior long-term patency, and radial artery and saphenous vein grafts are used to complement arterial strategies[19,20].

CABG provides durable angina relief, improves survival in left main and multivessel CAD, and outperforms percutaneous strategies in diabetes and complex anatomy; these advantages are strengthened by arterial grafting, while risks include perioperative complications and late failure of venous grafts[20,21]. Current operative mortality is low, and 5- and 10-year survival approximates 85–95 percent and 75 percent, respectively[22]. Long-term survival and major events are broadly similar between on-pump and off-pump techniques, with possible perioperative benefits of off-pump surgery in selected patients[23,24]. Bilateral arterial grafting improves patency without clear 10-year mortality differences[20]. Subsequent revascularization is driven largely by saphenous vein graft failure, which underscores the importance of conduit choice and secondary prevention[19].

By contrast, PCI achieves lesion modification with balloon dilation and usually stent implantation. Plain balloon angioplasty reduced stenosis but was limited by abrupt closure and restenosis; bare-metal stents preserved luminal caliber yet were prone to neointimal hyperplasia and recurrent narrowing[25]. Drug-eluting stents that elute sirolimus, everolimus, or zotarolimus substantially reduced restenosis and reintervention, and newer platforms with biocompatible polymers and ultrathin struts further optimized safety and efficacy[26,27]. PCI offers minimal invasiveness, rapid recovery, and effective symptom control. In low to moderate anatomic complexity, survival is comparable to CABG when modern techniques and drug-eluting stents are used, supporting PCI in patients with favorable anatomy or higher surgical risk as endorsed by American College of Cardiology and American Heart Association recommendations[16,28]. Residual risks include stent thrombosis, periprocedural infarction, restenosis, and repeat revascularization, the latter occurring more often than after CABG in multivessel disease. Prevention of late stent thrombosis requires prolonged antiplatelet therapy, and premature discontinuation of clopidogrel is a principal risk factor[28,29].

SURGICAL VERSUS PERCUTANEOUS CORONARY REVASCULARIZATION: AN EVIDENCE SYNTHESIS

In contemporary practice that incorporates physiologic lesion assessment with fractional flow reserve and the routine use of current-generation drug-eluting stents, the relative performance of PCI and CABG appears broadly comparable for survival and cerebrovascular events, although consistent differences persist for myocardial infarction and the need for repeat procedures (Table 1). In the FAME 3 trial, the 3-year incidence of the composite of death, myocardial infarction, or stroke did not differ significantly between strategies (12.0% with PCI versus 9.2% with CABG; HR 1.30, 95% CI 0.98–1.83), while myocardial infarction occurred more frequently after PCI (7.0% versus 4.2%; HR 1.70, 95% CI 1.1–2.7) and no differences were observed for death or stroke[30]. The final 5-year analysis corroborated this pattern by showing a similar rate of the composite of death, stroke, or myocardial infarction (16% with PCI versus 14% with CABG; HR 1.16, 95% CI 0.89–1.52), alongside higher rates of myocardial infarction (8% versus 5%; HR 1.57, 95% CI 1.04–2.36) and repeat revascularization (16% versus 8%; HR 2.02, 95% CI 1.46–2.79) in the PCI group, again without differences in all-cause death or stroke[28].

Table 1. Clinical outcomes of CABG and PCI in major patient groups.

Authors	Setting	N / Design	Follow-up	Primary/ Key Composite	Death	Myocardial Infarction	Stroke	Repeat Revascularization
Kirov et al. (2022) (31)	NSTE-ACS	48,891 / Meta-analysis	Long-term	Mortality: IRR 0.93 (0.70–1.23)	—	NS	—	Lower with CABG (IRR 0.37, 0.30–0.47)
Sabatine et al. (2021) (32)	Left main CAD (mostly low–intermediate complexity)	4,394 / IPD RCT meta-analysis	5 y	Death: HR 1.10 (0.91–1.32)	NS	Higher with PCI (HR 2.35, 1.71–3.23)	Overall NS; PCI lower in first year (HR 0.37, 0.19–0.69)	Higher with PCI (HR 1.78, 1.51–2.10)
Zimmermann et al. (2023) (FAME 3) (30)	3-vessel CAD (no LM), FFR-guided PCI with contemporary DES	1,500 / RCT	3 y	Death/MI/Stroke: 12.0% PCI vs 9.2% CABG (HR 1.30, 95% CI 0.98–1.83)	NS	Higher with PCI (7.0% vs 4.2%; HR 1.70, 1.1–2.7)	NS	—
Fearon et al. (2025) (FAME 3) (28)	3-vessel CAD (no LM), FFR-guided PCI with contemporary DES	1,500 / RCT	5 y	Death/MI/Stroke: 16% PCI vs 14% CABG (HR 1.16, 0.89–1.52)	NS (7% vs 7%)	Higher with PCI (8% vs 5%; HR 1.57, 1.04–2.36)	NS	Higher with PCI (16% vs 8%; HR 2.02, 1.46–2.79)
Holm et al. (2020) (NOBLE) (33)	Left main CAD	1,184 / RCT	5 y	MACCE higher with PCI (28% vs 19%; HR 1.58, 1.24–2.01)	NS	Higher with PCI (HR 2.99, 1.66–5.39)	NS	Higher with PCI (HR 1.73, 1.25–2.40)
Robich et al. (2022) (36)	Younger patients (<60 y) with LAD-involving 2-vessel or 3-vessel CAD	4,883 / Multicenter cohort	10 y	Survival	—	—	Higher stroke with CABG peri-op (1.3% vs 0.07%)	Lower with CABG (sHR 0.34, 0.28–0.40)
Völz et al. (2021) (37)	HFrEF + multivessel/LM	2,509 / National cohort	Median 3.9 y	All-cause mortality	—	—	—	—

CABG: coronary artery bypass grafting; CAD = coronary artery disease; DES = drug-eluting stent; FFR = fractional flow reserve; HFrEF = heart failure with reduced ejection fraction; IPD = individual patient data; LM = left main; MACCE/MACE = major adverse (cardiac/cardiovascular) events; NSTE-ACS = Non–ST-Elevation Acute Coronary Syndrome; PCI = percutaneous coronary intervention; RCT = randomized controlled trial; NS = not significant. Effect sizes are reported as in the source (HR/RR/IRR/OR).

In the setting of non-ST-elevation acute coronary syndrome, a meta-analysis of 13 observational cohorts encompassing 48,891 subjects reported no difference in long-term mortality between CABG and PCI (RR 0.93, 95% CI 0.70–1.23), while CABG was associated with a lower incidence of long-term major adverse cardiovascular events (RR 0.64, 95%CI 0.54–0.76) and a markedly reduced need for repeat revascularization (RR 0.37, 95%CI 0.30–0.47), with no differences in long-term myocardial infarction or perioperative mortality[31].

For left main CAD, randomized evidence synthesized at the patient level indicates comparable survival but persistent trade-offs across other endpoints. An individual patient data meta-analysis pooling SYNTAX, PRECOMBAT, NOBLE, and EXCEL showed no statistically significant difference in 5-year all-cause death between PCI and CABG (11.2% versus 10.2%; HR 1.10, 95%CI 0.91–1.32), yet spontaneous myocardial infarction and repeat revascularization occurred more often after PCI (HR 2.35, 95%CI 1.71–3.23 and HR 1.78, 95%CI 1.51–2.10, respectively). Stroke risk was similar overall, although a lower risk with PCI was observed during the first year after randomization (HR 0.37, 95%CI 0.19–0.69)[32]. Consistently, the 5-year update of NOBLE demonstrated the inferiority of PCI for the primary composite of major adverse cardiac or cerebrovascular events (28% versus 19%; HR 1.58, 95% CI 1.24–2.01), with similar all-cause mortality but higher rates of non-procedural myocardial infarction and repeat revascularization after PCI[33].

Considerations of procedural safety complement these comparative data. In a large institutional series, unplanned coronary dissection complicated 1.4% of 10,278 PCI procedures and was associated with substantial in-hospital major adverse cardiovascular events at 23% and a 20% long-term mortality rate, underscoring the clinical consequences of periprocedural events despite their infrequency[34]. Moreover, among subjects with ST-segment elevation myocardial infarction who underwent primary PCI and subsequently required CABG, outcomes did not differ between an initial balloon-only strategy and an initial stenting strategy, as in-hospital and 5-year mortality and major bleeding were similar, indicating that either approach is acceptable when surgery follows the index intervention[35]. Taken together, across three-vessel and left main disease with low to intermediate anatomical complexity, death and stroke are generally comparable at three to five years, whereas PCI is consistently associated with higher rates of spontaneous myocardial infarction and a greater likelihood of repeat revascularization, and CABG maintains advantages for durability and composite ischemic efficacy.

PRECISION REVASCULARIZATION: SUBGROUP DATA AND PCI ADVANCES

Age and left ventricular function exert a measurable influence on long-term outcomes and should inform revascularization strategy. In a multicenter cohort restricted to subjects younger than 60 years with either two-vessel disease involving the left anterior descending artery or three-vessel disease, CABG was associated with superior 10-year survival compared with PCI (HR 0.71, 95%CI 0.57–0.88) and a substantially lower incidence of repeat revascularization, although at the expense of a higher perioperative stroke risk (1.3% with CABG versus 0.07% with PCI)[36]. Similarly, in a national analysis of ischemic heart failure with reduced ejection fraction and multivessel or left main disease, CABG was associated with lower mortality after extensive adjustment (OR 0.62, 95% CI 0.41–0.96), and outcomes were progressively worse in hospitals where PCI was the preferred mode of revascularization, a pattern that underscores the interaction among case selection, institutional practice, and treatment effect[37].

Alongside these subgroup effects, advances in PCI techniques delineate scenarios in which percutaneous strategies achieve favorable medium-term results (Table 2). In a randomized study of selected ST-segment elevation myocardial infarction lesions, drug-coated balloon angioplasty produced very low two-year event rates and outcomes that were comparable to those of drug-eluting stents, although the small sample size and wide confidence intervals warrant cautious interpretation of precision[38]. In routine practice captured by a prospective registry, drug-coated balloons used for in-stent restenosis and de novo lesions were associated with acceptable safety, low bailout stenting, and target-lesion revascularization rates of 11.7% for in-stent restenosis and 2.9% for de novo disease at two years, indicating performance that varies with lesion substrate[39]. For complex large bifurcation disease that frequently involves the left main, a strategy of directional coronary atherectomy followed by drug-coated balloon angioplasty achieved a clinically driven target-lesion revascularization rate of 5.9% at thirty-six months, with no target-vessel myocardial infarction and no subsequent CABG, which demonstrates sustained effectiveness in experienced centers with established workflows[40]. Furthermore, lesion preparation with scoring balloons can enhance acute luminal gain and procedural success without excess complications, as the Wedge NC device was non-inferior to ScoreFlex for procedural success and generated greater acute lumen gain, although the impact of these differences on long-term clinical outcomes remains to be established in dedicated trials[41].

Table 2. Contemporary PCI technologies and procedural safety.

Authors	Setting	N / Design	Follow-up	Primary/ Key Endpoint	Key Results	Practical Interpretation
Kitani et al. (2025) (40)	LMT/ large bifurcations with DCA + DCB	129 (≈80% LMT) / Multicenter retrospective	36 mo (mean 53 mo)	CD-TLR	5.9% at 36 mo; no target-vessel AMI or CABG	Supports DCA+DCB as viable in expert centers
Chen et al. (2025) (Wedge NC Trial) (41)	Scoring balloons (lesion preparation)	198 / RCT	In-hospital	Procedural success	Non-inferior to ScoreFlex (98/99 vs 98/99); greater acute lumen gain; low complications	Tool for optimization; outcome impact long-term not assessed
Niehe et al. (2022) (REVELATION) (38)	DCB vs DES in STEMI (culprit lesion, selected anatomy)	120 / RCT	2 y	MACE (death, MI, TLR)	5.4% DCB vs 1.9% DES (HR 2.86; CI wide; P=0.34); very low event rates	In selected STEMI, DCB comparable to DES at 2 y; small trial
Vlieger et al. (2022) (PEARL) (39)	Real-world DCB (ISR & de novo, mixed complexity)	513 / Prospective registry	2 y	MACE; TLR	MACE 17.1% (ISR) & 9.7% (de novo); TLR 11.7% (ISR) & 2.9% (de novo); bailout stent 3.1%	DCB safe/effective with low bailout; outcomes depend on lesion type
Page et al. (2023) (34)	PCI procedural complication	10,278 PCI; 141 dissections	Mean 4.4 y	Dissection incidence/ outcomes	Dissection 1.4%; in-hospital MACE 23%; long-term death 20%	Rare but high-impact; underscores need for imaging/ technique
Ipek et al. (2021) (35)	Primary PCI strategy before subsequent CABG (balloon vs stent)	350 STEMI needing CABG	5 y	Mortality & bleeding	No differences in in-hospital or 5-y mortality; bleeding similar	Either ad-hoc strategy acceptable when CABG follows

AMI = acute myocardial infarction; CABG = coronary artery bypass grafting; CD = clinically driven; DCA = directional coronary atherectomy; DCB = drug-coated balloon; DES = drug-eluting stent; ISR = in-stent restenosis; LMT = Left Main Trunk; MACE = major adverse cardiovascular events; PCI = percutaneous coronary intervention; RCT = randomized controlled trial; STEMI = ST-Elevation Myocardial Infarction; TLR/TVR = target lesion/vessel revascularization.

IMPLICATIONS FOR CLINICAL PRACTICE

Current evidence indicates that CABG more reliably minimizes spontaneous myocardial infarction and the need for repeat revascularization, findings that are particularly relevant in younger patients and in those with ischemic cardiomyopathy. By contrast, PCI is a reasonable alternative in low to intermediate anatomical complexity, especially when rapid recovery and mitigation of perioperative cerebrovascular risk are priorities and when physiologic guidance, contemporary stent platforms, advanced bifurcation techniques, and intraprocedural imaging are systematically applied. The recurring observation of survival equivalence in several populations supports a deliberative process that integrates anatomical complexity, comorbidities, age, local expertise, and patient preferences, thereby aligning treatment with predefined clinical objectives and expected durability at three to five years[42–44].

Consistent with this evidence, the 2021 ACC, AHA, and SCAI revascularization guideline recommends CABG rather than PCI for significant left-main disease when overall coronary complexity is high and for multivessel disease with diffuse or complex anatomy, and it assigns a Class I preference to CABG in diabetes with multivessel disease involving the left anterior descending artery while permitting PCI when surgical candidacy is poor. In parallel, the document elevates physiologic assessment with fractional flow reserve or instantaneous wave-free ratio to Class I for angiographically intermediate lesions, recommends intravascular ultrasound to adjudicate intermediate left-main stenosis, and encourages formal grading of anatomic complexity with the SYNTAX score. These tools reduce uncertainty in lesion selection, improve the likelihood of complete revascularization, and help calibrate expectations regarding repeat procedures and infarction risk after PCI compared with surgery[4].

The 2024 ESC guideline for chronic coronary syndromes converges on the same principles and adds operational granularity. It identifies CABG as the preferred mode of revascularization in left-main disease overall, largely because of lower risks of spontaneous myocardial infarction and repeat revascularization, while explicitly allowing PCI in low-complexity left-main anatomy when comparable completeness can be achieved and considering PCI in intermediate complexity under the same proviso. For three-vessel disease without diabetes and with low to intermediate complexity, PCI is recommended as an alternative to CABG when equivalent completeness is deliverable, whereas in multivessel disease with diabetes CABG is favored when symptoms persist despite guideline-directed medical therapy. The document also issues Class I recommendations for intravascular imaging with intravascular ultrasound or optical coherence tomography and for physiologic assessment with fractional flow reserve or instantaneous wave-free ratio in complex lesions and multivessel disease, and it endorses routine use of SYNTAX and surgical risk tools to structure shared decision-making[5].

The 2025 ACC, AHA, ACEP, NAEMSP, and SCAI guideline for acute coronary syndromes modernizes the acute care pathway in ways that intersect with strategy selection. It reaffirms primary PCI for ST-elevation myocardial infarction and an early invasive approach for Non–ST-elevation acute coronary syndrome according to ischemic and bleeding risk, promotes radial access to reduce hemorrhagic complications, and emphasizes individualized antithrombotic therapy including tailored dual antiplatelet therapy selection and duration. These operational elements influence peri-procedural safety, the feasibility of prolonged antiplatelet therapy, and the timing of staged revascularization of nonculprit lesions in multivessel disease. They are concordant with prior revascularization guidance regarding which patients derive the greatest long-term benefit from surgical versus percutaneous strategies based on anatomic complexity, comorbidity, and the likelihood of durable completeness[45].

In practice, a structured Heart-Team pathway should link anatomy, comorbidity, and center capability to a tailored choice. Risk stratification should include formal assessment of anatomic complexity with SYNTAX and operative risk with the Society of Thoracic Surgeons operative risk score, coupled with explicit discussion of dual antiplatelet therapy feasibility, anticipated completeness of revascularization, and institutional outcomes for both PCI and surgery. In younger patients and in ischemic cardiomyopathy with reduced ejection fraction, observational data suggest superior long-term survival and fewer repeat procedures with surgery, which supports a surgical preference when anatomy is suitable. The early procedural stroke signal with CABG should be weighed carefully, particularly when PCI can achieve equivalent completeness in low-complexity anatomy. Where low to intermediate complexity permits full percutaneous revascularization and where physiology and imaging are used routinely, PCI is guideline-endorsed and may align better with patient goals regarding recovery time and perioperative risk. Across all scenarios, transparent communication of absolute and relative risks for death, myocardial infarction, stroke, and repeat revascularization at defined time horizons should anchor shared decision-making and ensure that the selected strategy reflects both the best available evidence and the informed preferences of the patient (Table 3).

Table 3. Practical directives aligned with current guidelines.

FOCUS	WHAT TO DO	WHEN / NOTES
Risk assessment	Calculate SYNTAX (anatomic complexity) and STS (operative risk) to frame Heart-Team discussion and counseling. Include ACS clinical risk (ischemic and bleeding).	Use for all candidates. In ACS, prioritize early invasive timing according to risk and default to radial access when feasible.
Access & antithrombotics	Use radial access to lower bleeding; individualize DAPT type and duration based on ischemic and bleeding risk.	Influences PCI safety and feasibility of prolonged DAPT; limited DAPT favors CABG over PCI.
Physiology & imaging	Apply FFR/iFR for intermediate lesions; guide complex PCI with IVUS/OCT and perform imaging-guided optimization before completion.	Particularly for left-main, long lesions, and true bifurcations. In ACS, use physiology/imaging for staged non-culprit decisions.
Prefer CABG	Choose surgery when durability and MI prevention are primary goals.	Diabetes with multivessel CAD; left-main with high complexity; ischemic cardiomyopathy with reduced LVEF.
Consider PCI	Select PCI when low–intermediate complexity and complete percutaneous revascularization is achievable.	Expect similar mid-term survival; acknowledge higher risks of spontaneous MI and repeat revascularization vs CABG. In ACS, perform culprit-lesion PCI first (STEMI) and stage remaining lesions by anatomy/physiology.
Shared decision-making	Present absolute and relative risks for death, MI, stroke, and reintervention at 3–5 years; align the strategy with patient goals and durability.	Heart-Team process integrating anatomy, comorbidities, life expectancy, center expertise, and DAPT feasibility.

ACS = acute coronary syndromes; CABG = coronary artery bypass grafting; CAD = coronary artery disease; DAPT = dual antiplatelet therapy; FFR/iFR = fractional flow reserve / instantaneous wave-free ratio; IVUS/OCT = intravascular ultrasound / optical coherence tomography; LVEF = left ventricular ejection fraction; MI = myocardial infarction; PCI = percutaneous coronary intervention; STS = Society of Thoracic Surgeons risk score.

In summary, current evidence indicates that CABG and PCI achieve broadly similar survival and stroke rates in low to intermediate anatomical complexity when revascularization is complete and modern techniques are applied. Nevertheless, CABG more consistently reduces spontaneous myocardial infarction and the need for repeat revascularization, whereas PCI offers faster recovery and a lower early perioperative stroke risk. These trade-offs should frame patient counseling and the default strategy in scenarios without a clear anatomical preference.

Furthermore, benefit is primarily determined by anatomy and comorbidity. CABG retains a durability advantage in left main disease with high complexity, in multivessel disease with diabetes, and in ischemic cardiomyopathy with reduced left ventricular ejection fraction, provided that complete surgical revascularization is achievable. Conversely, PCI is appropriate in left main disease with low complexity and in three-vessel disease without diabetes when complete percutaneous revascularization is feasible. Outcomes for both strategies are enhanced by process quality, including physiology-guided lesion selection, intravascular imaging for complex PCI, and evidence-based conduit selection for CABG.

Finally, decision-making should be structured and transparent. Formal assessment with SYNTAX and STS scores, explicit evaluation of dual antiplatelet therapy feasibility, and multidisciplinary Heart-Team deliberation are essential to align treatment with clinical objectives and expected durability. Acute coronary syndrome pathways refine implementation through radial access, individualized antithrombotic therapy, and staged management of nonculprit lesions. Future research should address comparative effectiveness of all-arterial CABG versus physiology- and imaging-guided PCI, optimal antiplatelet strategies after complex PCI, and long-term patient-reported outcomes.

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