European Journal of Cardio-Thoracic Surgery 2024, 66(4), ezae360
https://doi.org/10.1093/ejcts/ezae360

Cite this article as: Doenst T, Borger M, Falk V, Milojevic M. ESC/EACTS guideline for chronic coronary syndrome—invasive treatment perspectives important for daily practice. Eur J Cardiothorac Surg 2024; doi:10.1093/ejcts/ezae360.

ESC/EACTS guideline for chronic coronary syndrome—invasive treatment perspectives important for daily practice

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Received 17 September 2024; accepted 1 October 2024

Keywords: Clinical practice guidelines • Chronic coronary syndrome • Stable coronary artery disease • Coronary artery bypass grafting • Percutaneous coronary intervention

BACKGROUND

In August 2024, the new ESC Guidelines for the Management of Chronic Coronary Syndrome (CCS), endorsed by EACTS, have been published [1]. From a surgical perspective, this document is pivotal, as the ESC has shifted its guideline development focus from procedure-oriented to patient-centred and disease-based perspectives. This shift integrates several traditionally separate but interconnected documents—such as those for CCS, myocardial revascularization [2], and both STEMI and non-STEMI guidelines [3, 4] into a unified framework for the diagnosis and treatment of CCS [1] and Acute Coronary Syndromes (ACSs) [5]. While EACTS proposed retaining the previous scope and multidisciplinary aspects of the myocardial revascularization Guidelines, the ESC has opted to continue with the new integrated approach. It is also crucial to acknowledge the challenges posed by the strict word count limits of the new guideline document, which must be adhered to even when merging 2 comprehensive documents into one. This constraint may necessitate sacrificing detailed and important recommendations essential for daily clinical practice. However, the new guidelines contain several excellent changes and additions with regard to prevention, diagnosis and the integration of treatment options, in addition to a general upgrade of invasive treatment compared to other current guidelines [6, 7].

Nevertheless, the reduction in a text has relevant consequences, specifically for the recommendations on procedure specifics of coronary artery bypass grafting (CABG) and percutaneous coronary intervention (PCI) for the invasive treatment of chronic coronary artery disease (CAD). The space allotted to procedural details has been limited to only a fraction of the space in the original myocardial revascularization guidelines [2]. Since the previous recommendations were not renewed and the knowledge, techniques and technology have rapidly evolved since the last version of this document, some of these previous recommendations have become obsolete [8]. Hence, more weight and effort for appropriate 'decision-making' will fall onto the Heart Team with regard to individual patient treatment recommendations until perhaps other bodies will fill this guidance gap in the future. Thus, all Heart Team members' competence and data awareness become increasingly important.

The 2024 CCS guidelines now provide up-to-date recommendations for the main scenarios in the daily treatment of patients with CAD. As in all guidelines, these recommendations result from interpreting the data published in peer-reviewed journals following extensive discussions on the available evidence in light of contemporary practice. The committee opted for a non-mechanistic approach to interpreting the data, which allowed some inconsistencies with previous and other guidelines to persist, reflecting the partial contradictions in trial results. In addition, the committee chose not to introduce new terminology, which might have helped to resolve some of these controversies. In the following text, we will present the updated recommendations and address inconsistencies, controversies, strengths and weaknesses, clearly summarizing the new guidelines' essence and emphasizing the critical information essential for daily clinical practice.

SUMMARY OF RECOMMENDATIONS

All recommendations for the invasive treatment of CCS by CABG or PCI have practically been summarized in 2 recommendation Tables [1]. Table 22 of the original guideline (here reproduced as Table 1) provides the primary indications for invasively treating patients with chronic CAD, while Table 23 of the original

Table 1: Recommendations for invasive therapy in patients with chronic coronary syndrome

Informed and shared decisions
• COR I, LoE C: It is recommended that patients scheduled for percutaneous or surgical revascularization receive complete information about the benefits, risks, therapeutic consequences and alternatives to revascularization, as part of shared clinical decision-making
• COR I, LoE C: For complex clinical cases, to define the optimal treatment strategy, in particular when CABG and PCI hold the same level of recommendation, a Heart Team discussion is recommended, including representatives from interventional cardiology, cardiac surgery, non-interventional cardiology and other specialties if indicated, aimed at selecting the most appropriate treatment to improve patient outcomes and quality of life
• COR I, LoE C: It is recommended to communicate the proposal of the Heart Team in a balanced way using language that the patient can understand
• COR I, LoE C: It is recommended that the decision for revascularization and its modality be patient-centred, considering patient preferences, health literacy, cultural circumstances and social support
• COR I, LoE C: It is recommended that the Heart Team (on site or with a partner institution) develop institutional protocols to implement the appropriate revascularization strategy in accordance with current guidelines
Revascularization to improve outcomes
• **In patients with left ventricular ejection fraction >35%**
○ COR I, LoE A: In CCS patients with LVEF >35%, myocardial revascularization is recommended, in addition to guideline-directed medical therapy, for patients with functionally significant left main stem stenosis to improve survival
○ COR I, LoE A: In CCS patients with LVEF >35%, myocardial revascularization is recommended, in addition to guideline-directed medical therapy, for patients with functionally significant three-vessel disease to improve long-term survival and to reduce long-term cardiovascular mortality and the risk of spontaneous myocardial infarction
○ COR I, LoE B: In CCS patients with LVEF >35%, myocardial revascularization is recommended, in addition to guideline-directed medical therapy, for patients with functionally significant single- or two-vessel disease involving the proximal LAD, to reduce long-term cardiovascular mortality and the risk of spontaneous myocardial infarction
• **In patients with left ventricular ejection fraction ≤35%**
○ COR I, LoE C: In CCS patients with LVEF ≤35%, it is recommended to choose between revascularization or medical therapy alone, after careful evaluation, preferably by the Heart Team, of coronary anatomy, correlation between coronary artery disease and LV dysfunction, comorbidities, life expectancy, individual risk-to-benefit ratio and patient perspectives
○ COR I, LoE B: In surgically eligible CCS patients with multivessel CAD and LVEF ≤35%, myocardial revascularization with CABG is recommended over medical therapy alone to improve long-term survival
○ COR IIb, LoE B: In selected CCS patients with functionally significant MVD and LVEF ≤35% who are at high surgical risk or not operable, PCI may be considered as an alternative to CABG
Revascularization to improve symptoms
• COR I, LoE A: In CCS patients with persistent angina or anginal equivalent, despite guideline-directed medical treatment, myocardial revascularization of functionally significant obstructive CAD is recommended to improve symptoms
Assessment of procedural risks and post-procedural outcomes
• COR I, LoE C: In patients with complex CAD in whom revascularization is being considered, it is recommended to assess procedural risks and post-procedural outcomes to guide shared clinical decision-making
• COR I, LoE B: Calculation of the STS score is recommended to estimate in-hospital morbidity and 30-day mortality after CABG
• COR I, LoE B: In patients with multivessel obstructive CAD, calculation of the SYNTAX score is recommended to assess the anatomical complexity of disease
• COR I, LoE A: Intracoronary imaging guidance by IVUS or OCT is recommended when performing PCI on anatomically complex lesions, in particular left main stem, true bifurcations and long lesions
• **Intracoronary pressure measurement (FFR or iFR) or computation (QFR)**
- COR I, LoE A: is recommended to guide lesion selection for intervention in patients with multivessel disease
- COR IIa, LoE B: should be considered at the end of the procedure to identify patients at high risk of persistent angina and subsequent clinical events
- COR IIb, LoE B: may be considered at the end of the procedure to identify lesions potentially amenable to treatment with additional PCI
Choice of revascularization modality
• COR I, LoE C: It is recommended that physicians select the most appropriate revascularization modality based on patient profile,[a] coronary anatomy,[b] procedural factors,[c] LVEF, preferences and outcome expectations

CABG: coronary artery bypass grafting; CAD: coronary artery disease; CCS: chronic coronary syndrome; COR: class of recommendation; FFR: fractional flow reserve; iFR: instantaneous wave-free ratio; IVUS: intravascular ultrasound; LAD: left anterior descending; LoE: level of evidence; LV: left ventricular; LVEF: left ventricular ejection fraction; MVD: multivessel disease; OCT: optical coherence tomography; PCI: percutaneous coronary intervention; QFR: quantitative flow ratio; STS: Society of Thoracic Surgeons; SYNTAX: SYNergy Between PCI with TAXUS and Cardiac Surgery.

[a]Age, frailty, cognitive status, diabetes and any other comorbidities.

[b]Multivessel disease with/out left main stem involvement, high anatomical complexity and likelihood of revascularization completeness.

[c]Local expertise and outcomes, surgical and interventional risk.

guideline (here reproduced as Table 2) then distinguishes between the modes of invasive treatment, specifically CABG or PCI. The content aligns broadly with the current recommendations on the management of CCS of American societies [6, 7] and suggests 'revascularization' in patients with relevant obstructive CAD. CABG is the gold standard of care in patients with anatomically complex CAD, as assessed by the SYNergy Between PCI with TAXUS and Cardiac Surgery (SYNTAX) score, as well as those with left main coronary artery disease (LMCAD) with multivessel disease (MVD), diabetes mellitus (DM) and/or heart failure. Table 24 in the original guideline document [1] further details the diagnosis and medical management of CCS patients with heart failure. This recommendation acknowledges that CABG, but not PCI, has been demonstrated to improve prognosis in this specific patient population.

Table 1 (Guideline Table 22) is divided into 5 subsections, starting with informed and shared decision-making, requesting a solid role for the Heart Team and the importance of detailed patient information before any final treatment decision is made (Fig. 1). A significant new feature in this table is the recommendation for a Heart Team discussion in cases where CABG and PCI hold the same levels of recommendation. This recommendation received a

Table 2: Anatomically and clinically based recommendations for invasive therapy in chronic coronary syndrome

Left main disease
- In CCS patients at low surgical risk[a] with significant left main coronary stenosis, CABG:
  - COR I, LoE A is recommended over medical therapy alone to improve survival;
  - COR I, LoE A is recommended as the overall preferred revascularization mode over PCI, given the lower risk of spontaneous myocardial infarction and repeat revascularization
- COR I, LoE A: In CCS patients with significant left main coronary stenosis of low complexity (SYNTAX score ≤22), in whom PCI can provide equivalent completeness of revascularization to that of CABG, PCI is recommended as an alternative to CABG, given its lower invasiveness and non-inferior survival
- COR IIa, LoE A: In CCS patients with significant left main coronary stenosis of intermediate complexity (SYNTAX score 23–32), in whom PCI can provide equivalent completeness of revascularization to that of CABG, PCI should be considered, given its lower invasiveness and non-inferior survival

Left main disease with MVD
- COR I, LoE A: In CCS patients at low surgical risk with suitable anatomy, CABG is recommended over medical therapy alone to improve survival
- COR IIb, LoE B: In CCS patients at high surgical risk, PCI may be considered over medical therapy alone

Multivessel disease[b] and diabetes
- COR I, LoE A: In CCS patients with significant multivessel disease and diabetes, with insufficient response to guideline-directed medical therapy, CABG is recommended over medical therapy alone and over PCI to improve symptoms and outcomes
- COR IIa, LoE B: In CCS patients at very high surgical risk, PCI should be considered over medical therapy alone to reduce symptoms and adverse outcomes

Three-vessel disease, without diabetes
- COR I, LoE A: In CCS patients with significant three-vessel disease, preserved LVEF, no diabetes and insufficient response to guideline-directed medical therapy, CABG is recommended over medical therapy alone to improve symptoms, survival and other outcomes
- COR I, LoE A: In CCS patients with preserved LVEF, no diabetes, insufficient response to guideline-directed medical therapy, and significant three-vessel disease of low-to-intermediate anatomic complexity in whom PCI can provide similar completeness of revascularization to that of CABG, PCI is recommended, given its lower invasiveness, and generally non-inferior survival

Single- or double-vessel disease
- **Involving the proximal LAD**
  - COR I, LoE A: In CCS patients with significant single- or double-vessel disease involving the proximal LAD and insufficient response to guideline-directed medical therapy, CABG or PCI is recommended over medical therapy alone to improve symptoms and outcomes
  - COR I, LoE B: In CCS patients with complex significant single- or double-vessel disease involving the proximal LAD, less amenable to PCI, and insufficient response to guideline-directed medical therapy, CABG is recommended to improve symptoms and reduce revascularization rates
- **Not involving the proximal LAD**
  - COR I, LoE B: In symptomatic CCS patients with significant single- or double-vessel disease not involving the proximal LAD and with insufficient response to guideline-directed medical therapy, PCI is recommended to improve symptoms
  - COR IIb, LoE C: In symptomatic CCS patients with significant single- or double-vessel disease not involving the proximal LAD and with insufficient response to guideline-directed medical therapy, not amenable to revascularization by PCI, CABG may be considered to improve symptoms

CABG: coronary artery bypass grafting; CCS: chronic coronary syndrome; COR: class of recommendation; LAD: left anterior descending; LoE: level of evidence; LVEF: left ventricular ejection fraction; PCI: percutaneous coronary intervention; SYNTAX: SYNergy Between PCI with TAXUS and Cardiac Surgery.

[a]For example, absence of previous cardiac surgery, or severe morbidities, or frailty, or immobility precluding CABG.

[b]Multivessel disease is defined as the involvement of at least 2 main coronary arteries.

class of recommendation (COR) I and has significant practical implications, as it discourages the widely established *ad hoc* PCI practice and reaffirms the vital role of multidisciplinary, informed, shared decision-making processes in these cases. Additionally, the table underscores the Heart Team's and policymakers' critical role in establishing institutional protocols that will help implement guidelines and promote their adherence. This recommendation applies to all Heart Centres, whether they have cardiac surgery facilities on site or not.

The 2nd subsection of Table 1 provides recommendations for invasive therapy aimed at improving outcomes, specifying the desired clinical outcome for each individual recommendation. 'Revascularization' received a COR I for patients with left ventricular ejection fraction (LVEF) >35% and functionally significant LMCAD, three-vessel disease, as well as for patients with functionally significant single- or two-vessel disease. Based on the available evidence, the targeted outcomes vary for these recommendations, shifting from improving overall survival to reducing long-term cardiovascular mortality or spontaneous myocardial infarctions (MIs).

In patients with CCS and LVEF ≤ 35% (3rd subsection), Heart Teams should decide between revascularization and medical therapy. CABG has received a COR I indication for surgically eligible patients to improve survival. Additionally, the writing committee has issued a COR IIb for PCI as a potential alternative treatment option in cases where patients are not operable, although it does not specify a particular treatment goal.

In the 4th subsection of Table 1, a general COR I is provided for revascularization of functionally significant obstructive CAD to improve symptoms if medical therapy is not sufficient. The 5th subsection describes the well-established recommendations for risk-benefit assessment, including the use of the Society of Thoracic Surgeons (STS) score for predicting CABG mortality and the SYNTAX score for assessing the anatomical complexity of CAD. It also details the use of intracoronary imaging for PCI and the generation of individual patient treatment recommendations.

Table 2 (Guideline Table 23) then addresses the mode of revascularization. Unlike the central table in the previous Myocardial Revascularizazion (MR) guidelines, which classically compared CABG versus PCI, this common differentiation is absent. The Table starts with LMCAD with or without MVD recommendations. CABG is the overall preferred treatment option over PCI, given the markedly lower risk of spontaneous MI and the need for repeat revascularization during long-term follow-up (COR I). PCI received an equal COR I for LMCAD cases with SYNTAX score ≤22 and a COR IIa for those with SYNTAX scores between 22 and 32 in patients in whom PCI can provide equivalent completeness of revascularization to CABG. Previously

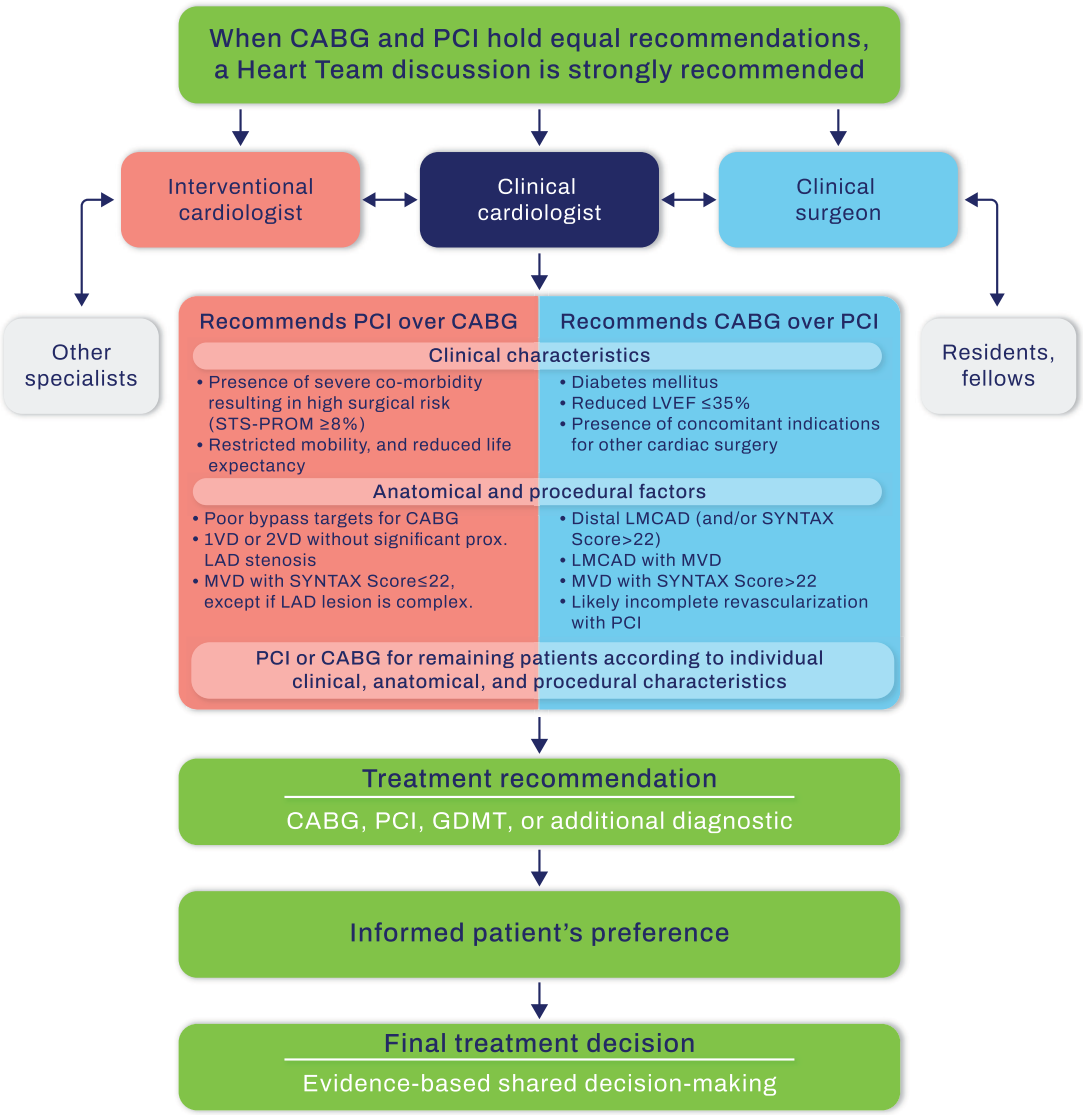


Figure 1: Role of the Heart Team and key considerations in decision-making between percutaneous coronary intervention and coronary artery bypass grafting in patients with stable multivessel and/or left main coronary artery disease. CABG: coronary artery bypass grafting; GDMT: guideline-directed medical therapy; LAD: left anterior descending artery; LMCAD: left main coronary artery disease; LVEF: left ventricular ejection fraction; MVD: multivessel disease; PCI: percutaneous coronary intervention; STS-PROM: Society of Thoracic Surgeons predicted risk of mortality; VD: vessel disease.

categorized high SYNTAX score patients are now integrated into a new category encompassing LMCAD with MVD. While this category includes patients with a high SYNTAX score, it also extends to numerous clinical scenarios for patients with low and intermediate SYNTAX scores. Thus, it should not be considered for application only to patients with high SYNTAX scores. In this revised grouping, CABG remains COR I, while PCI is assigned a COR IIb for patients in whom surgery is not a viable option.

For patients with MVD and DM, CABG has a general COR I to improve survival. PCI received a COR IIa for reducing symptoms in selected high-surgical-risk patients with MVD with DM. CABG has received COR I for all three-vessel disease patients without DM, while PCI received the same COR I for patients with lower or intermediate SYNTAX scores, preserved LVEF and in whom PCI can provide similar completeness of revascularization to CABG, based on its non-inferior survival compared to CABG in this patient population. Finally, for patients with single- or two-vessel disease, both CABG and PCI have a COR I when the proximal left anterior descending (LAD) artery is involved. In the absence of proximal LAD involvement, the primary goal shifts to symptom reduction, with PCI maintaining COR I and CABG designated as COR IIb. It is crucial to note the new specification for cases with complex LAD disease. In such scenarios, CABG, preferably minimally invasively [9], is preferred over PCI for its ability to reduce symptoms and re-revascularization rates.

WHAT HAS CHANGED, AND WHAT IS NEW?

These new recommendations largely maintain the direction established by ESC/EACTS joint previous myocardial revascularization guidelines [2] and differ from the American guidelines [7] with its strong recommendation for invasive treatment (specifically CABG) in patients with MVD and normal ejection fraction.

The American downgrading had been heavily criticized for an inappropriate interpretation of the ISCHEMIA (REF Maron *et al.* NEJM 2020) data.

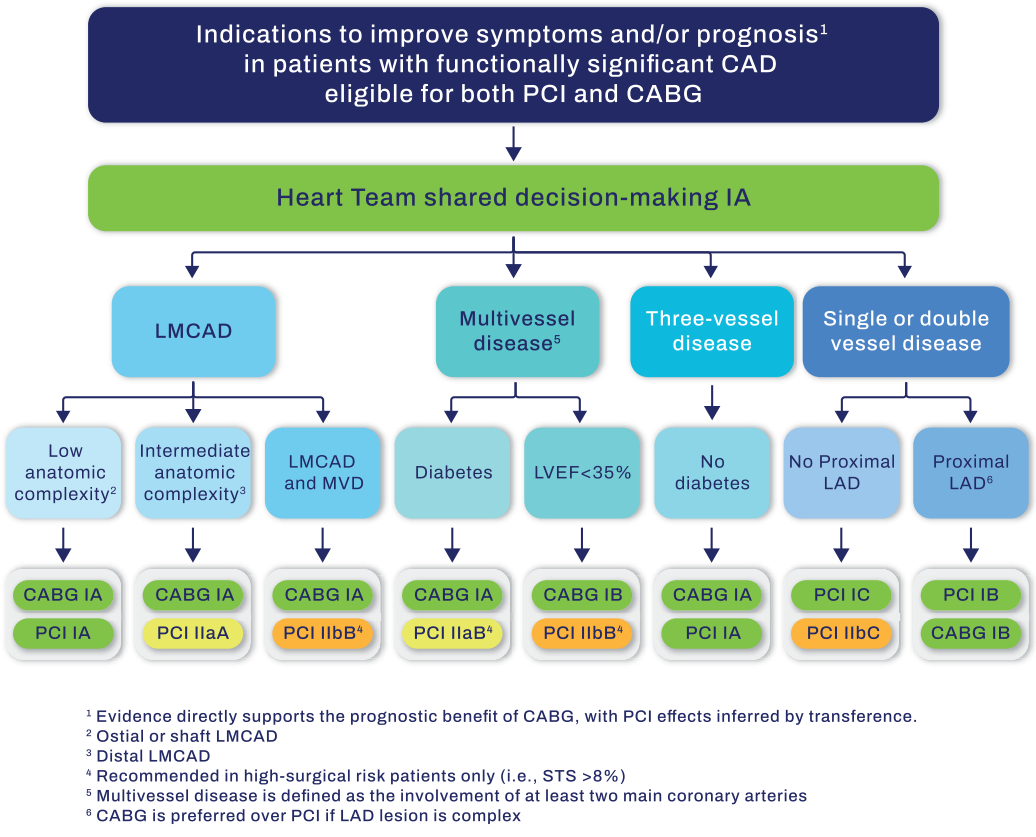
The new ESC/EACTS guidelines underscore the crucial role of the Heart Team's decision-making process in collaboration with patients, particularly emphasizing the avoidance of *ad hoc* interventions in cases that may particularly benefit from CABG, as highlighted in Class I scenarios. Clearly, patients with complex CAD hold a primary CABG recommendation. Meanwhile, PCI is mainly endorsed for its symptom-relieving effects in patients with less complex CAD who remain symptomatic despite intensive guideline-directed medical therapies (Fig. 2).

We consider it less relevant to focus on individual differences or to comment in detail on changes from previous guidelines since these are often due to different interpretations of previously available and new data, as well as the perceived value of randomized and non-randomized evidence. However, it is important to highlight areas not fully covered by the current guidelines or leave room for interpretation due to gaps in evidence. This situation is partially attributable to the required brevity of the section and the challenge of covering the full spectrum of invasive CAD treatment, encompassing 5 decades of research that is more extensive than in most other areas, within just a few manuscript pages and 2 recommendation tables. Our comments follow the order of the tables, going from most complex to least complex CAD.

PATIENTS WITH CORONARY ARTERY DISEASE INVOLVING THE LEFT MAIN CORONARY ARTERY

The 2024 CCS guidelines acknowledge the strong treatment benefits of CABG in these patients, stating in Table 2 (Guideline Table 23) that CABG is recommended as the overall preferred revascularization mode over PCI due to its lower risk of spontaneous MI and repeat revascularization during follow-up [1]. During the course of the guideline development, a consensus document was developed to re-evaluate the previous recommendations for invasive LMCAD treatment [10], prompted by disagreements between the myocardial revascularization guideline committee members that occurred over interpretations of the EXCEL trial data [11]. This new consensus document assigned COR I for CABG and COR IIa for PCI in patients with SYNTAX scores between 0 and 32. It also suggested removing the SYNTAX score as a discriminator of anatomic complexity and instead providing a table with specific features supporting 1 treatment option or the other [10].

Although the 2024 CCS guidelines endorse the left main consensus statement in their narrative, the recommendation tables still sub-classify PCI according to the SYNTAX score. From a surgical perspective, it is crucial to note that the guidelines now explicitly address the impact of distal left main lesions on PCI outcomes, acknowledging worse clinical outcomes with stenting



[1] Evidence directly supports the prognostic benefit of CABG, with PCI effects inferred by transference.
[2] Ostial or shaft LMCAD
[3] Distal LMCAD
[4] Recommended in high-surgical risk patients only (i.e., STS >8%)
[5] Multivessel disease is defined as the involvement of at least two main coronary arteries
[6] CABG is preferred over PCI if LAD lesion is complex

Figure 2: Algorithm to assist in selecting the appropriate revascularization procedure for patients with multivessel or left main coronary artery disease. The class of recommendations and level of evidence (as indicated on the right side of the PCI and CABG diagram, as recommended) are based on the 2024 ESC Guidelines for the management of chronic coronary syndromes developed in collaboration with EACTS. CABG: coronary artery bypass grafting; CAD: coronary artery disease; LAD: left anterior descending artery; LMCAD: left main coronary artery disease; MVD: multivessel disease; PCI: percutaneous coronary intervention.

bifurcation lesions compared to non-bifurcation lesions. This information is critical to consider in future Heart Team discussions. In addition, the Heart Team needs to acknowledge that the large majority of patients with LMCAD also have MVD [12].

Another crucial detail for the Heart Team is understanding the meaning of risk classification. The 2024 CCS guidelines continue to recommend the STS predicted risk of mortality score for surgical risk assessment, which predicts 30-day mortality. However, there is no recommendation for assessing 30-day mortality after PCI, even though the BCIS II-score from the REVIVED trial could have served this purpose [13]. It is essential to realize that in all randomized data [14, 15] as well as in most risk-adjusted registry data [16, 17], 30-day mortality rates after CABG or PCI are practically equal. It is also important to know what thresholds the 2024 CCS guidelines use to stratify surgical risk categories. High surgical risk is considered as predicted mortality of above 8% (STS-predicted risk of mortality >8) [18], with values below 4% regarded as low risk and intermediate risk falling between 4% and 8%.

Risk stratification is particularly important when considering CABG and PCI recommendations for LMCAD. Here, if the surgical risk is high, PCI may be favoured over medical therapy alone in patients with LMCAD with MVD (i.e. STS-predicted risk of mortality score $>$ 8%). This is an important change in the treatment approach, as the previous COR III against PCI in this patient population has been modified to IIb. The Heart Team, therefore, now has more discretion to consider PCI as a rescue option for symptomatic patients defined as inoperable, which would (based on the above risk classification) suggest a risk well above 8%.

PATIENTS WITH SINGLE TO MULTIVESSEL CORONARY ARTERY DISEASE

The recommendations for patients with CAD not involving the LM have remained mainly the same, with 1 change that is relevant for surgeons on the Heart Team. For patients with single- or double-vessel disease, CABG has received a primary recommendation over PCI when dealing with complex LAD lesions that are less amenable to PCI [1]. This represents a stronger position advocating for more careful multidisciplinary patient selection compared to the previous myocardial revascularization guidelines, which suggested that either CABG or PCI could be performed and left the door open for more *ad-hoc* interventions.

Furthermore, the COR IIb for CABG in patients with one- or two-vessel disease without proximal LAD stenosis involvement has been clarified without altering the level of recommendation. CABG may now be considered for improving symptoms in patients who are not suitable candidates for PCI and who have not responded adequately to guideline-directed medical therapy. This change is due to the fact that there is no evidence suggesting that CABG under these conditions has a life-prolonging effect.

PATIENTS WITH CORONARY ARTERY DISEASE AND HEART FAILURE

In patients with CAD and reduced LVEF (defined as EF $\leq$ 35%), the clearly neutral clinical outcomes (including survival and changes in contractile function) of the REVIVED BCIS2 Trial [13] led to a modification in the recommendation level for PCI. This trial compared PCI plus optimal medical therapy against optimal medical therapy alone in patients with inducible ischaemia and LVEF $<$ 35%. The guidelines have now adjusted the recommendations for PCI in these patients to COR IIb (previously IIa irrespective of surgical risk), suggesting PCI as a treatment modality only in selected CCS patients with functionally significant MVD and LVEF $\leq$ 35% who are at high surgical risk or not operable. Conversely, based on the survival advantage demonstrated by STICH extended follow-up [19], the COR I for CABG has been maintained, reinforcing the role of surgery as the gold standard of care in these patients for the foreseeable future.

WHAT IS MISSING AND WHAT REMAINS UNCLEAR?

As stated above, the required brevity of the section on invasive treatment of CAD has vastly limited the ability to address all important aspects of care for both CABG and PCI procedures. As a result, certain topics and procedural guidance are missing or not sufficiently defined to assist physicians in daily practice. We herein summarize important areas that may require further clarification or inclusion in future accompanying documents.

TIMING OF CORONARY ARTERY BYPASS GRAFTING AND PERCUTANEOUS CORONARY INTERVENTION

There is no mention of a time frame within which CABG or PCI would be considered safe after the Heart Team has indicated invasive treatment. Consequently, it remains reasonable to adhere to the previous recommendations, which suggested that once a decision for PCI or CABG is made, the procedure should ideally be performed within a 2-week window for high-risk patients and within 6 weeks for all others [2]. The established timeframe could be debated, especially in light of new evidence from the ISCHEMIA trial [20], which indicated that an initial invasive diagnostic and treatment strategy did not confer a survival benefit in patients with MVD. However, this trial also showed a risk of cardiovascular death or spontaneous MI of 3.4% at 6 months in the initially conservative group [20]. Thus, if the decision to undergo invasive treatment has been made, waiting longer time periods adds this conservative risk to the invasive one. Therefore, the previously suggested times for intervention or surgery still appear reasonable.

CHRONIC CORONARY SYNDROME VERSUS ACUTE CORONARY SYNDROME

Patients with chronic CAD frequently progress to ACS. Previous recommendations (from both the myocardial revascularization and STEMI guidelines [2, 3]) as well as those from the 2023 ESC ACS guidelines [5] recommended applying the CCS decision algorithm to patients with 'stable' ACS. Practically, this recommendation applies to all NSTEMI patients without very high-risk features. Such patients do not require immediate angiography, but angiography should be performed within 24 h [5].

The rationale for this approach is based on the understanding that patients with complex CAD derive the most significant treatment benefits from CABG, particularly due to the prognostic advantages of surgical collateralization [21], as presented in the text below. This benefit is unlikely to be compromised by an acute condition that does not increase operative mortality, making surgery a viable option for these patients, as also recently reviewed by Besola *et al.* [22]. It underscores the relevance of these recommendations in the treatment of ACS patients.

INCONSISTENCIES RELATED TO TERMINOLOGY

Historically, the invasive treatment of CAD was restricted to CABG as the only treatment option, primarily focused on the elimination of angina as the main clinical presentation [23]. Since the elimination of flow obstructions from the stenosed coronary vasculature was the primary treatment goal, it is clear why 1st CABG [24] and later PCI [25] were termed 'revascularization', implying that restoration of normal flow is key for achieving a treatment effect. However, it was recently illustrated that the term 'revascularization' does not adequately describe the underlying treatment mechanism exploited to achieve individual treatment goals [26]. A mechanism-oriented approach to the invasive treatment of CAD may help resolve some controversies resulting from previously published studies [21, 26, 27].

Briefly, reperfusion is the mechanism of invasive treatment when acute (i.e. ongoing) ischaemia is present. This is the main treatment mechanism for most patients with ACS, especially those with STEMI. In CCS, flow at rest is sufficient because ischaemia has to be induced to detect it (i.e. stress protocols are diagnostically employed). Thus, the underlying mechanism for the treatment of inducible ischaemia is not reperfusion, but the increase in coronary flow capabilities (i.e. more flow is possible when needed upon exertion). All available evidence stemming from several large trials, including COURAGE, ISCHEMIA and REVIVED [13, 20, 28], suggests that the treatment of inducible ischaemia alleviates symptoms, but does not prolong life. Yet, trials assessing CABG in patients with CCS demonstrated survival advantages of CABG both over PCI [14] and medical therapy [19], and this treatment effect could be related to CABG's ability to significantly reduce future MIs [21, 29]. Surgical collateralization was therefore introduced as a term to describe this life-prolonging mechanism of CABG [21]. It is based on the prevention of future MI and may even apply to PCI. Still, the potential of guideline-conform PCI focusing on flow-limiting lesions is very limited because the vast majority of MIs arise from non-flow-limiting lesions (Fig. 3).

From this mechanistic perspective, it may seem incorrect to recommend 'revascularization' to improve survival, as stated in Table 22 of the 2024 CCS guidelines for patients with LMCAD and triple vessel CAD, because this effect has never been demonstrated for PCI. However, if the specific recommendations in Guideline Table 23 (Table 2) on the mode of invasive treatment are considered for decision-making, the suggested treatment recommendation should also be consistent with a mechanistic approach described above. Such an approach would require Heart Teams in the future to assess the risk of MI arising from the load of CAD present in vessels with flow obstructions currently triggering the need for invasive treatment. If the risk is high, CABG will be superior to PCI because of the collateralization mechanism associated with CABG. If the risk is low and the results of PCI can be expected to be durable (e.g. stenting a single shaft lesion in the LM), long-term outcomes are likely to be the same. This rationale also explains the new primary recommendation for CABG in single- and double-vessel disease if the LAD is severely affected.

CONCLUDING REMARKS

This 2024 ESC/EACTS Guideline for the management of CCS was developed in collaboration of the 2 societies, which differs from a unilateral approach to this disease entity (from the cardiology side) in North America. The new European guideline marks a significant advancement in addressing the challenges associated with the ongoing discussions around the 2018 ESC/EACTS Guidelines on myocardial revascularization. It effectively re-establishes a European tradition of joint guideline development that we consider critical for providing optimal benefits to patients and the broader medical community. The document facilitates multidisciplinary decision-making for patients with CCS who are candidates for both PCI and CABG procedures, preserving the valuable legacy of years of collaborative efforts. It emphasizes the importance of collaboration among surgeons, interventionalists and clinical cardiologists, together with shared decision-making with the patient, to ensure comprehensive care that prioritizes optimal patient safety and long-term efficacy.

Despite making considerable progress in bridging significant gaps between previous guideline documents, there remains an imperative need for a more inclusive multidisciplinary approach to guideline development. Integrating the surgical and other communities as an equal partner is essential for crafting recommendations that affect millions worldwide. This strategy aims to reduce the likelihood of critical health decisions based on individual perception-driven health literacy instead of evidence-based, shared decision-making processes. Additionally, this guideline underscores the necessity to enhance the procedural dimensions of both CABG and PCI, which could maximize the benefits derived from these interventions, continuing a long-established European practice that has consistently delivered widespread advantages.

FUNDING

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Conflict of interest: Volkmar Falk declares institutional financial activities (educational grants including travel support, fees for lectures/speeches, fees for professional consultation and research/study funds) with the following commercial entities: Medtronic GmbH, Biotronik SE&Co, Abiomed GmbH, Abbott GmbH&CoKG, Edwards Lifesciences, Berlin Heart, Novartis Pharma GmbH, JOTEC/CryoLife GmbH and LivaNova. The other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

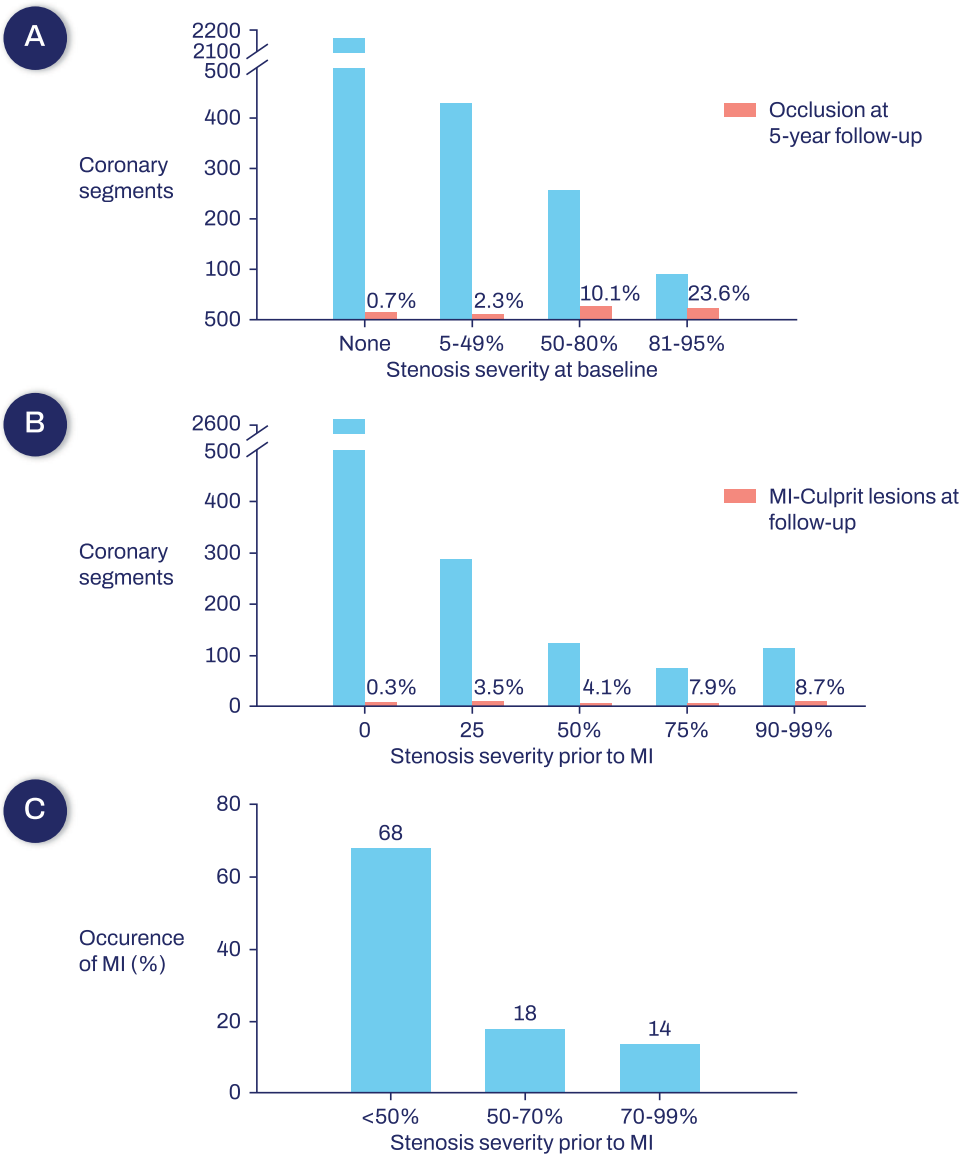


Figure 3: Bar graphs showing stenosis severity and associated risk of coronary occlusion and myocardial infarction as evaluated by serial angiographic examination. The more stenotic an individual coronary segment is at baseline, the more frequently it progresses to occlusion (**A**) and/or gives rise to infarction (**B**). Because less-obstructive plaques by far outnumber severely obstructive plaques, most occlusions and infarctions result from the progression of the less-obstructive plaques. Thus, myocardial infarction evolves most frequently from plaques that are only mildly to moderately obstructive (**C**) (Adopted from Doenst *et al.* [21] with permission from Elsevier). MI: myocardial infarction.

DATA AVAILABILITY

No new data were generated or analysed in support of this research.

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European Journal of Cardio-Thoracic Surgery, 2024, 66, 1–9
https://doi.org/10.1093/ejcts/ezae360
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