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REVIEW

2018 ESC/EACTS Guidelines on Myocardial Revascularization: Review of the Most Important Issues

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KEY WORDS: *Coronary artery disease, myocardial revascularization, guidelines*

Abbreviation List:
ACS: Acute coronary syndrome
CABG: Coronary artery bypass grafting procedure
CAD: Coronary artery disease
CTO: Chronic total occlusion
DAPT: Dual antiplatelet therapy
DES: Drug-eluting stents
DM: Diabetes mellitus
EACTS: European Association for Cardio-Thoracic Surgery
ESC: European Society of Cardiology
HF: Heart failure
FFR: Fractional Flow Reserve
SCAD: Stable coronary artery disease
IABP: Intra-aortic balloon pump
IVUS: Intravascular Ultrasound
LM: Left main
LVEF: Left ventricular ejection fraction
MACCE: Major adverse cardiac and cerebrovascular events
MB: Main branch
MVD: Multivessel disease
MR: Mitral regurgitation
NOAC: Non-Vitamin K antagonist oral anticoagulants
OAC: Oral anticoagulation
OCT: Optical coherence tomography
PCI: Percutaneous Coronary Intervention
RCT: Randomized controlled trial
SB: Side branch
STEMI: ST-segment elevation myocardial infarction
NSTEMI: Non-ST-segment elevation acute coronary syndrome

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ABSTRACT

The ESC and the EACTS have collaborated to issue the 3rd updated Guidelines regarding myocardial revascularization. The present document highlights the key messages and changes of the recent Guidelines regarding: the broad use of DES, the impact of functional assessment of intermediate-grade stenosis especially in MVD, the importance of intracoronary imaging and finally the trend towards extending DAPT.

INTRODUCTION

Fifty years after the 1st CABG, the ESC and the EACTS have collaborated to issue the 3rd updated guidelines regarding myocardial revascularization. In these guidelines, ESC and EACTS provide recommendations for revascularization of SCAD, NSTEMI, STEMI, and revascularization in patients with different risk factors. The authors underline the importance of the interaction between cardiologists, cardiac surgeons, and referring physicians for choosing the best possible revascularization approach. Herein we represent the key messages of the recently published 2018 guidelines. Summaries of the key changes in comparison with the previous Guidelines are provided in Figures 1 and 2.

ACCESS:

The radial access should be the preferred approach for coronary angiography and PCI, unless there are overriding procedural considerations, (class I recommendation). However, the benefit of radial over femoral access depends upon the operator's expertise in the radial technique[1].

STENTS:

Implantation of new-generation DES is the standard treatment strategy irrespective of clinical presentation, lesion type, anticipated duration of DAPT, or concomitant anticoagulant therapy (class I recommendation)[2]. Bare metal stents should be used exceptionally.

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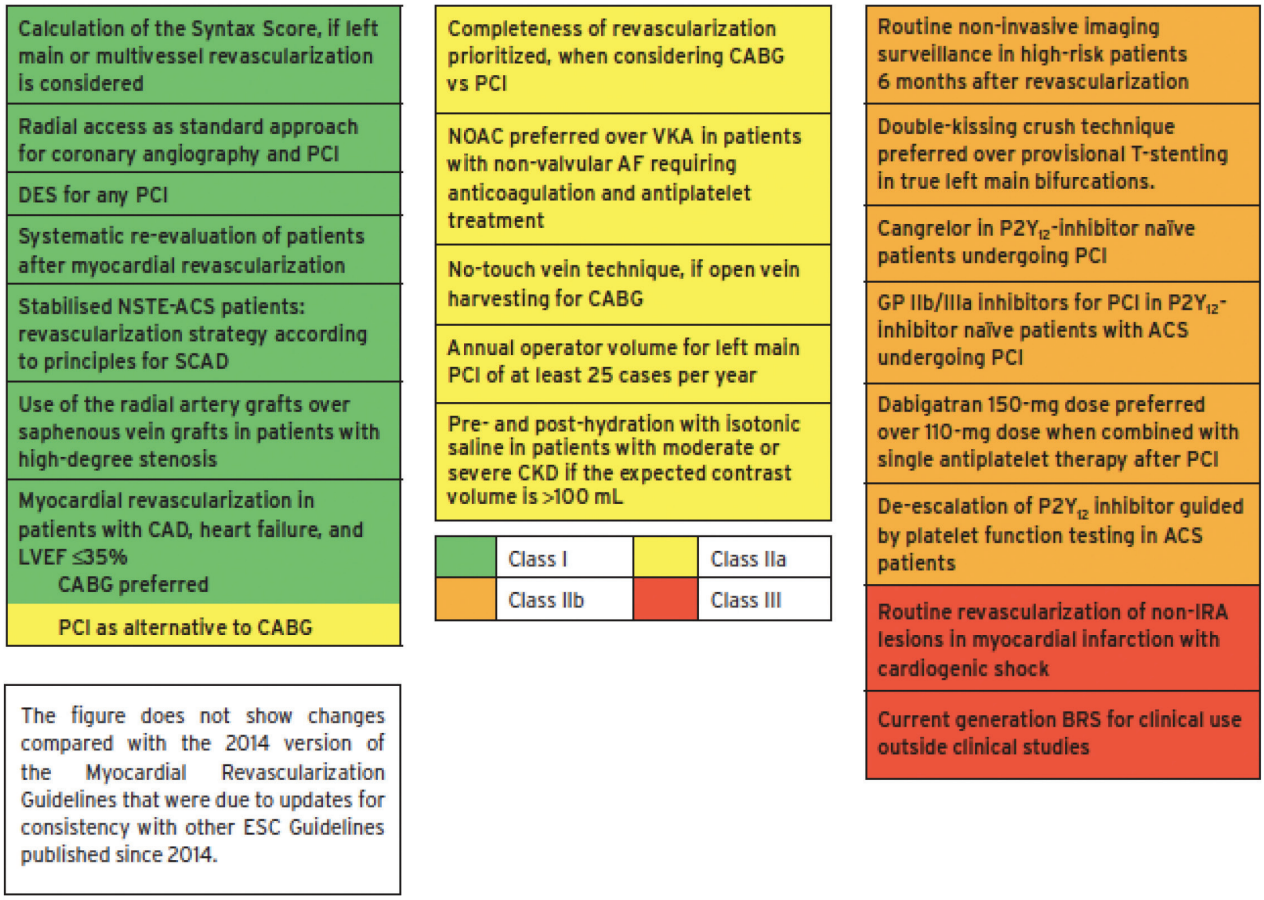


ACS = acute coronary syndromes; AF = atrial fibrillation; BRS = bioresorbable scaffolds; CABG = coronary artery bypass grafting; CAD = coronary artery disease; CKD = chronic kidney disease; DES = drug-eluting stents; FFR = fractional flow reserve; GP = glycoprotein; IRA = infarct-related artery; LVEF = left ventricular ejection fraction; NOAC = non-vitamin K oral anticoagulants; NSTEMI = non-ST-elevation; PCI = percutaneous coronary intervention; SCAD = stable coronary artery disease; VKA = vitamin K antagonists. [under the permission of Academic Rights & Licensing of Oxford University Press, Rights Link order #501492596].

FIGURE 1. New recommendations of the recent guidelines.

STABLE CORONARY ARTERY DISEASE:

Optimal medical therapy is of important value in patients with SCAD (ORBITA Trial). However, in such patients revascularization indications are the persistence of symptoms despite guideline-recommended medical treatment and/or the improvement of prognosis. Revascularization reduces the use of antianginal drugs, improves exercise capacity and quality of life compared with conservative strategy alone during short- and long-term follow-up. Therefore, the ability to achieve complete revascularization is a key issue when choosing the appropriate treatment strategy (Class IIa indication). SCAD patients with complex CAD, anatomy as reflected by a high (>33) SYNTAX score (*http://www.syntaxscore.com*), such as patients with left main or 3-vessel disease (3VD), should be generally discussed by the Heart Team and not be treated ad-hoc[3].

ISOLATED PROXIMAL LEFT ANTERIOR DESCENDING CAD:

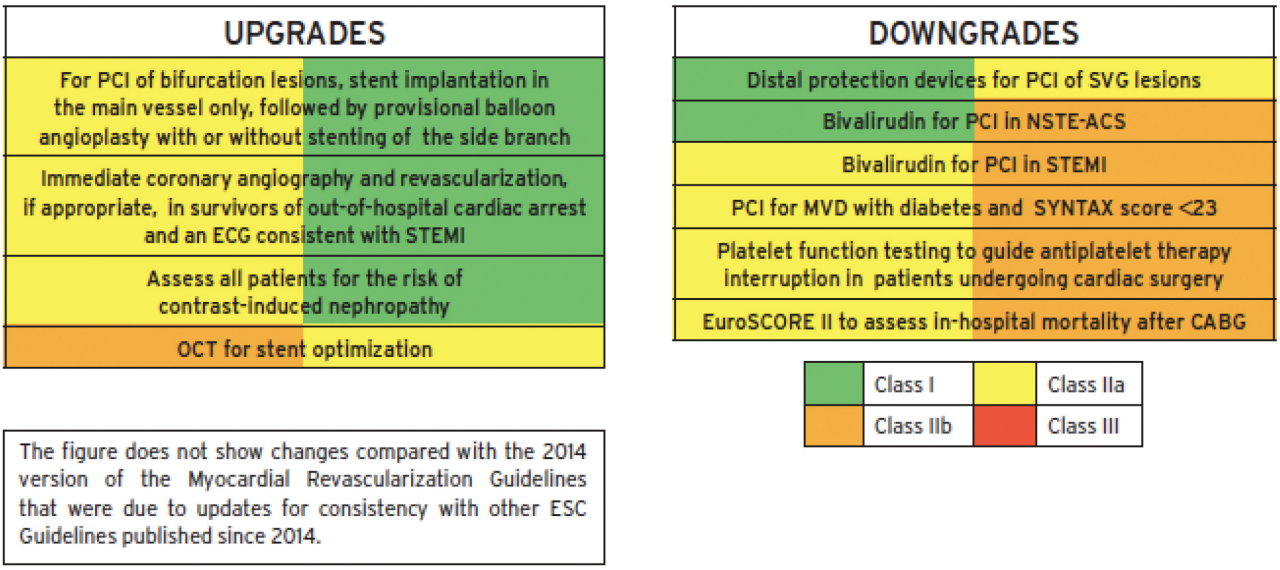
Both CABG and PCI share similar outcomes in terms of death, myocardial infarction, and stroke (class I recommendation). However, we should point out the higher risk of repeat revascularization in PCI group[4].

MULTIVESSEL DISEASE:

In SCAD patients calculation of Syntax score should be consider (class I recommendation)[3]. PCI should not be used in case of 3VD with intermediate or high SYNTAX score (>22) especially when DM is combined (class III indication).

LEFT MAIN CORONARY DISEASE:

CABG is "always an option," with a class I indication in all patients regardless of SYNTAX Score. However, patients



CABG = coronary artery bypass grafting; MVD = multivessel coronary artery disease; NSTE-ACS = non-ST-elevation acute coronary syndromes; OCT = optical coherence tomography; PCI = percutaneous coronary interventions; STEMI = ST-elevation myocardial infarction, SVG = saphenous vein grafts; [under the permission of Academic Rights & Licensing of Oxford University Press, Rights Link order #501492596].

FIGURE 2. Upgrading or undergrading recommendations based on the recent guidelines.

with left main disease and low SYNTAX score (<23), PCI is a class I recommendation. For those with an intermediate (23-33) and high (>33) SYNTAX score, PCI is a class IIa and III recommendation, respectively.

BIFURCATION LESIONS:

MB standalone stenting with provisional stenting of the SB should be the preferred approach (class I indication, upgrade) for most bifurcation lesions. Exceptions to this rule (where upfront SB stenting may be preferable) include the presence of a large SB (≥2.75mm) with a long ostial SB lesion (>5mm) or anticipated difficulty in accessing an important SB after MB stenting, and true distal LM bifurcations. When a 2-stent strategy is necessary, which technique should be preferred is debated. In LM true bifurcation lesions, double-kissing crush has the most favorable outcome data.

CABG:

The superiority of CABG over medical therapy was established in a meta-analysis of seven RCTs more than two decades ago, demonstrating a survival benefit of CABG in patients with SCAD and LM or 3VD, particularly when the proximal Left Anterior Descending artery was involved[5]. Multiple arterial grafting should be considered using the radial artery for high-grade stenosis and/or BIMA grafting for patients who do not have an increased risk of sternal wound infection. Off-pump surgery with no-touch aorta for high-risk patients should also be considered. In patients with ongoing ischemia or hemodynamic instability with an indication for CABG, emergency surgery should be performed and not postponed as a consequence of antiplatelet treatment exposure.

NON-ST-SEGMENT ELEVATION ACS:

The principles of SCAD should be applied in all stabilized patients with NSTE-ACS. In patients with MVD NSTE-ACS complete revascularization of significant lesions should be attempted. The prognosis of patients with incomplete revascularization is known to be worse. In addition, complete one-stage revascularization strategy is associated with better clinical outcome compared to multistage PCI.

ST-SEGMENT ELEVATION MYOCARDIAL INFARCTION:

Routine revascularization of non-infraction related lesions should be considered in STEMI patients with MVD before hospital discharge (class IIa recommendation).

CARDIOGENIC SHOCK:

Acute myocardial ischemia in the setting of ASC is the antecedent event for the majority of patients with cardiogenic shock undergoing percutaneous revascularization. In such patients the routine revascularization of non-culprit lesions is not recommended (Class III indication). In patients with Cardiogenic Shock routine use of IABP is not recommended (IABP SHOCK Trial)[6].

HEART FAILURE:

In patients with regional wall motion abnormalities and HF can be caused by stunned or hibernating myocardium and may be reversed by revascularization. Assessment of myocardial viability may be done in order to select patients that are more likely to benefit from myocardial revascularization and can be achieved with several imaging modalities. According to STICH trial 10 years results coronary revascularization is superior in improving survival in patients with HF (LVEF ≤35%) of ischemic origin, compared with medical therapy alone (Class I indication)[7]. However, the optimal revascularization strategy is not well defined. The choice between CABG and PCI should be made by the Heart Team after careful evaluation of the patient's clinical status and coronary anatomy, expected completeness of revascularization, myocardial viability, coexisting valvular disease, and comorbidities. As a rule, PCI should be considered in older patients without DM in whom complete revascularization can be achieved, whereas CABG is preferred in younger patients with more extensive CAD, or those with DM. In patients with DM and LV moderate or severe dysfunction, CABG is associated with better long-term survival and reduced incidence of MACCE.

REVASCULARIZATION AND VALVULAR HEART DISEASE:

Mitral Valve disease:

Patients with concomitant severe primary MR should undergo mitral valve repair at the time of CABG in keeping with guidance for the surgical repair of primary MR. Controversy exists about the treatment of moderate secondary or ischemic MR in patients undergoing CABG. However, mitral valve surgery is indicated in patients with severe secondary MR undergoing CABG and LVEF >30% (Class I indication). Surgery should be considered in symptomatic patients with severe secondary MR and LVEF <30%, but with evidence of myocardial viability and an option for surgical revascularization.

Aortic Valve disease:

In the current era of rapid developments in transcatheter valve implantation technologies, a decision regarding replacement of the aortic valve for moderate stenosis/regurgitation should be carefully considered on a case-by-case basis in collaboration with the Heart Team[8].

PRESSURE-DERIVED FRACTIONAL FLOW RESERVE:

According to new guidelines the current standard of care for the functional assessment of lesion severity in patients with intermediate-grade stenosis (40–90% stenosis) without evidence of ischemia in non-invasive testing is FFR, (class I indication). Moreover compared to intravascular imaging, hemodynamic assessment with FFR should be preferred for this indication, using as a cut of point the value of ≤0.80. Indeed, studies (such as DEFER or DEFINE-FLAIR Trials) have shown that PCI can be safely deferred if FFR is >0.75[9].

Ostial lesions and FFR:

Special care must be taken to avoid a wedge position of the guiding catheter and using intravenous rather than intracoronary adenosine.

MVD AND FFR:

FFR may be useful for the selection of lesions requiring revascularization in patients with MV CAD and should be the preferred management strategy in such patients, (class IIa recommendation)[10]. However, in NSTEMI patients the prognostic role of FFR needs further clarification.

LM AND FFR:

The presence of intermediate grade LM stem disease is not infrequent and angiographic evaluation may be challenging. Assessment using FFR is more challenging vs. non-LMS stenosis due to the requirement for disengagement of the guiding catheter and an inability to administer ic adenosine. It is important to consider the potential influence of any untreated downstream disease in the Left Anterior Descending or left circumflex arteries, which may be associated with an increased risk of a false negative FFR.

AORTIC STENOSIS AND FFR:

In case of concomitant severe AS and intermediate CAD there are no adequate RCT data supporting the use of FFR for the guidance of revascularization decisions.

FFR AND IC VS. IV ADENOSINE ADMINISTRATION:

Iv administration provides a stable and maximal hyperemia and thus should be recommended.

INTRAVASCULAR IMAGING:

IVUS is an ultrasound-based modality with an axial resolution of about 150 μm, allowing a real-time tomographic assessment of: vessel size, lumen area, and plaque composition and volume[11]. In comparison the OCT, which is a light-based modality, has more limited spatial resolution but better penetration depth allowing a better vessel sizing. OCT for stent optimization received an upgrade in to Class IIa recommendation. Both imaging modalities can be used for control of optimum stent apposition. Potential clinical use of intravascular imaging for diagnostic assessment in patients being considered for myocardial revascularization is also the evaluation of stenosis severity in lesions with intermediate-grade stenosis. However, based on a recently published prospective registry showing moderate correlation between minimal lumen area and FFR values we suggest the use of FFR as a modality of choice[9].

LM and IVUS:

Assessment of intermediate-grade LM disease using IVUS is supported by data coming from observational studies using as a cut of point of Minimal lumen area (MLA) <6mm^2, (class IIa recommendation).

ANTIPLATELET TREATMENT:

The type and the duration of DAPT should be individualized according to ischemic and bleeding risks, and must appropriately adapted during follow-up (Figure 3). Based on this judgment, treatment durations for DAPT after DES that are as short as 1 month or even as long as lifelong may be reasonable. However, is generally recommended after PCI in SCAD a 6 months DAPT, while in ACS a 12 months DAPT[9].

ANTICOAGULATION TREATMENT:

Compared with OAC therapy alone, the addition of DAPT to OAC therapy results in a 2- to 3-fold increase in bleeding complications. Every effort should be undertaken to avoid bleeding[10]. Based on the favorable bleeding risk in the large phase 3 studies, NOACs should be preferred over Vitamin K antagonists (Class IIa indication)[9]. In general, strategies to avoid bleeding complications in OAC patients should be:

- Assessment of ischemic and bleeding risks using validated risk predictors (e.g. CHA_2DS_2-VASc and HAS-BLED) with a focus on modifiable risk factors.
- Triple therapy duration must be kept as short as possible, dual therapy after PCI (OAC and clopidogrel) to be considered instead of triple therapy.
- Clopidogrel should be the $P2Y_{12}$ inhibitor of choice.
- Low-dose (≤100 mg/d) of aspirin should be used.
- NOACs should be preferred in patients with non-valvular atrial fibrillation requiring OAC and antiplatelet treatment, (class IIa recommendation).

Patients **unfavorable for a combination** of OAC and antiplatelet therapy are those with: advanced age, end stage renal disease, anemia, poor mental status, short life expectancy, ongoing malignancy, prior major bleeding or hemorrhagic stroke and chronic alcohol abuse. Whereas, patients with **high risk for ischemic events** are those with: diffuse MVD, especially in

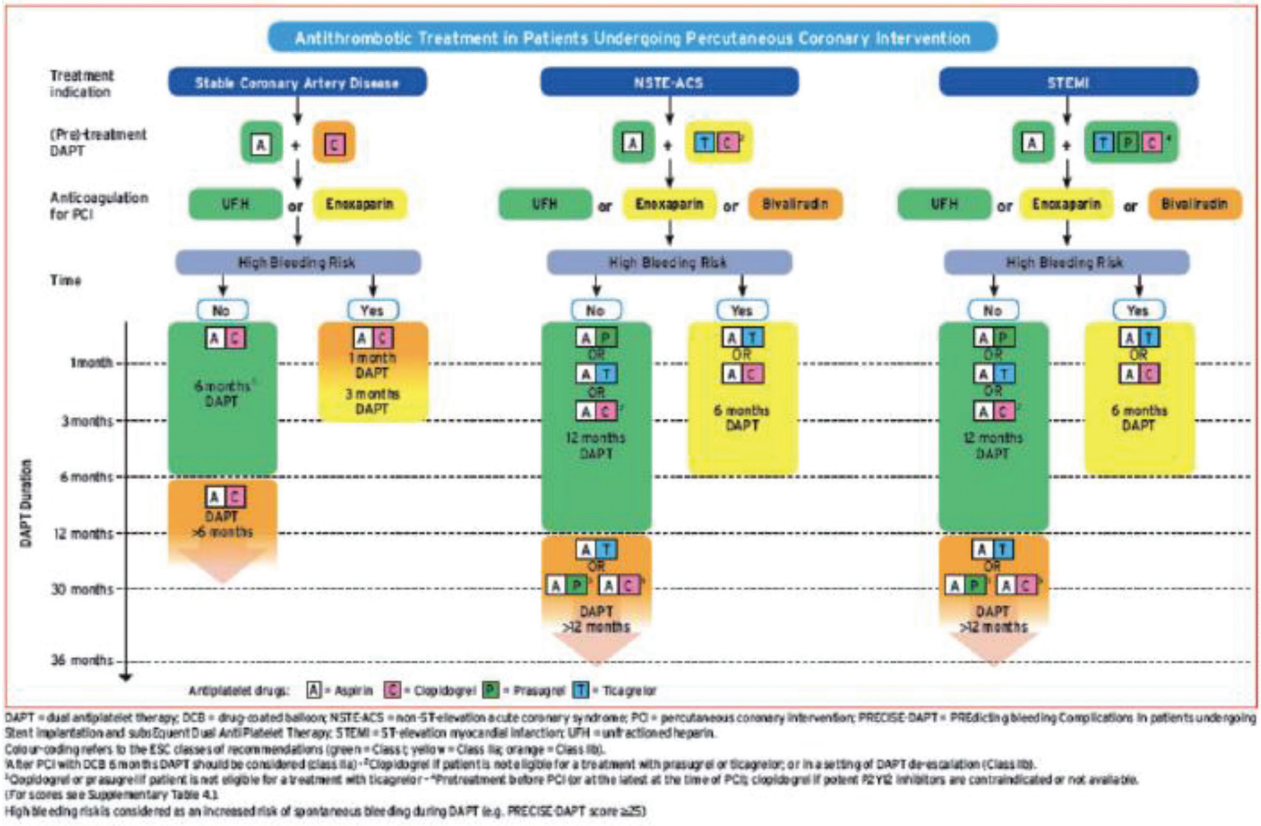


FIGURE 3. Graphic summarizing the different options of DAPT with its durations based on the different characteristics of the patients (SCAD vs. ACS).

diabetic patients, BLs, CTOs, long stented length (>60mm), multiple (>3) stent implantation, prior stent thrombosis, or renal failure.

CONCLUSIVE REMARKS

With this paper we briefly highlight the key messages and changes of the recent Guidelines on Myocardial Revascularization regarding: the broad use of DES, the impact of functional assessment of intermediate-grade stenosis especially in MVD, the importance of intracoronary imaging and finally the trend towards extending DAPT. However, there are many gaps (Table 1) that should be addressed in a future version.

TABLE 1. Gaps in the new guideline recommendations

NSTE-ACS: There are no dedicated prospective studies on the revascularization strategy with MVD.
STEMI: Patients undergoing primary PCI benefit from full revascularization however the optimal timing of treatment of the non-culprit lesion is not known.
Valvular Heart Disease: In patients with concomitant valvular and coronary disease, the possibility of future transcatheter therapy for the aortic and mitral valves has made a significant impact on decision-making for patients with predominantly coronary disease with moderate valve lesions.
Atrial fibrillation: The duration of anticoagulation and their combination with antiplatelet therapy in patients with new-onset AF after PCI or CABG has not been studied sufficiently studied.
CKD: Patients with CKD have been excluded from randomized trials on myocardial revascularization. A randomized trial on optimal long-term revascularization strategies in patients with moderate-to-severe CRD is currently ongoing.

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