

Questions and answers on coronary revascularization: a companion document of the 2015 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation[†]

Authors: Marco Valgimigli¹, Carlo Patrono², Jean-Philippe Collet³, Christian Mueller⁴, Marco Roffi^{5*}

Document Reviewers: Helmut Baumgartner (CPG Review Coordinator) (Germany), Oliver Gaemperli (CPG Review Coordinator) (Switzerland), Jose Luis Zamorano (CPG Chairperson) (Spain)

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¹Thoraxcenter, Erasmus Medical Center, Rotterdam, The Netherlands, ²Istituto di Farmacologia, Università Cattolica del Sacro Cuore, Rome, Italy, ³Institut de Cardiologie, Groupe Hospitalier Pitié-Salpêtrière, Paris, France, ⁴Department of Cardiology and Cardiovascular Research Institute Basel (CRIB), University Hospital, Basel, Switzerland, ⁵Division of Cardiology, University Hospital, Geneva, Switzerland

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* Corresponding author: Marco Roffi, Division of Cardiology, University Hospital, Rue Gabrielle Perret-Gentil 4, 1211 Geneva 14, Switzerland, Tel: +41 22 37 23 743, Fax: +41 22 37 27 229, E-mail: Marco.Roffi@hcuge.ch.

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Keywords

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Q1: A patient with rise and fall of cardiac troponin, T-wave inversion in the lateral leads and mild hypokinesia in the lateral wall on echocardiography undergoes coronary angiography that reveals three-vessel coronary artery disease (CAD), with subocclusion of the left circumflex coronary artery (LCX) and involvement of the distal tract of the left main stem. The internal medicine resident asks you whether, in this era of modern non-invasive imaging, invasive coronary angiography maintains a central role in the assessment of patients with non-ST-segment elevation acute coronary syndrome (NSTEMI-ACS).

Invasive coronary angiography allows, in the majority of cases, confirmation of the diagnosis of ACS related to obstructive epicardial CAD or to rule out a coronary origin of chest pain, to identify the culprit lesion, to assess the suitability of coronary anatomy for percutaneous coronary intervention (PCI) and coronary artery bypass grafting (CABG), to stratify short- and long-term patient risk and, finally, to guide antithrombotic treatment and potentially avoid unnecessary exposure to antithrombotic agents (section 5.6.1).

Q2: Do all NSTEMI-ACS patients undergoing an invasive management have a single clearly identifiable culprit lesion?

No. Angiographic patterns of CAD in NSTEMI-ACS patients may be extremely diverse, ranging from normal epicardial coronary arteries to a severely and diffusely diseased coronary tree. Up to 20% of patients with NSTEMI-ACS have no CAD or non-obstructive lesions of epicardial coronary arteries, while among patients with obstructive CAD, 40–80% have multi-vessel disease. Bypass graft failures and left main coronary artery disease may be the underlying condition in 5% and up to 10%, respectively, of patients presenting with NSTEMI-ACS. Multiple ruptured plaques may coexist in patients presenting with NSTEMI-ACS. Apparently normal findings at coronary angiography, i.e. absence of lumen narrowing, do not rule out the diagnosis of NSTEMI-ACS since plaque rupture and concomitant (transient) thrombus formation may not be detected by coronary angiography (section 5.6.1).

Q3: A 69-year-old patient with a history of hypertension was admitted to the coronary care unit with a working diagnosis of NSTEMI-ACS based on chest pain, troponin elevation and absence of ST-segment elevations on 12-lead electrocardiogram (ECG). Coronary angiography showed a total

occlusion of a big posterolateral branch of the LCX. Is the diagnosis of NSTEMI-ACS appropriate in the presence of a completely occluded coronary artery?

Yes. Nearly one-quarter of non-ST segment elevation myocardial infarction (NSTEMI) patients present with an acute occluded coronary artery and in two-thirds of the cases the occlusion is already collateralized at the time of coronary angiography. It should be noted that the occlusion of relatively small vessels, especially supplying blood to the lateral or posterolateral myocardium, but sometimes also major vessels such as the LCX, may not cause ST elevation on a standard 12-lead ECG. Patients with NSTEMI-ACS due to severe three-vessel CAD may present with diffuse ST depression (sections 3.3.1 and 5.6.1).

Q4: A colleague asks whether the identification of the culprit lesion/vessel in patients with NSTEMI-ACS is always possible. What is your answer?

While in the majority of cases the identification of the culprit lesion is straightforward, at times the differentiation between an acute/subacute and chronic occlusion may be challenging. In addition, in up to 40% of NSTEMI-ACS patients with obstructive CAD, multiple complex plaques fulfilling the criteria of a culprit lesion may be observed. If coronary flow in the presumptive infarct-related artery is normal, which is the case in ~50% of NSTEMI patients, identification of the culprit lesion based solely on angiography may at times not be possible (section 5.6.1).

Q5: Is coronary angiography the only tool for identifying the culprit lesion/vessel?

No, information gathered from ECG, echocardiography and left ventriculography may contribute to identification of the culprit lesion and should be integrated with angiographic features at the time of coronary angiography. At this stage, routine use of intravascular imaging modalities in an attempt to identify the culprit lesion cannot be recommended (section 5.6.1).

Q6: A 46-year-old patient with transient chest pain as well as rise and fall of troponin undergoes coronary angiography, which reveals the presence of a significant lesion in the mid left anterior descending coronary artery (LAD) and a critical stenosis in the distal right coronary artery (RCA). How should this patient be managed if no clear culprit lesion/vessel can be identified? In such a case, should an invasive plaque imaging by intravascular ultrasound (IVUS) or optical coherence tomography (OCT) be performed?

In this setting, revascularization of all putative lesions is frequently performed, especially if no culprit lesion can be identified. The presence of a localized wall motion abnormality on echocardiography or ventriculography may help identify the culprit artery. The use of IVUS or OCT has been repeatedly reported to also help identify the presence of potentially culprit lesions based on the identification of ruptured plaques and/or the presence of coronary thrombus. However, routine use of these intravascular imaging modalities is currently not recommended, as they are costly, may carry additional risks of complications and their clinical value in improving patients' outcome is not established (section 5.6.1).

Q7: In NSTEMI-ACS patients, should assessment of the severity of a given coronary stenosis and the decision to proceed to revascularization be routinely based on fractional flow reserve (FFR) results?

Failure to achieve maximal vasodilation and hyperaemia of the microvascular coronary bed may lead to overestimation of FFR and, as a result, to underestimation of coronary stenosis severity. While maximal hyperaemia is easy to achieve in patients with stable CAD, in NSTEMI-ACS patients this may be unpredictable due to the dynamic nature of coronary lesions and the acute microvascular dysfunction. The value of an FFR-based revascularization strategy in NSTEMI-ACS has not been adequately investigated (section 5.6.1).

Q8: A 75-year-old diabetic man presents with suspected NSTEMI-ACS based on acute typical chest pain and transient ST depression on ECG. Is it fair to say that he may benefit more from an early invasive strategy than a 50-year-old non-diabetic patient with suspected NSTEMI-ACS but no ECG changes?

There are no randomized studies addressing the value of early invasive strategy in these patient populations. Nevertheless, an individual patient data meta-analysis of three NSTEMI-ACS randomized trials with 5-year follow-up data reported a lower risk of cardiovascular death or myocardial infarction (MI) in patients undergoing routine vs. selective invasive strategy, and the most pronounced difference was observed in high-risk patients. High-risk characteristics (i.e., independent predictors of death and non-fatal MI at follow-up) in this study included age, diabetes, previous MI, ST depression at presentation and treatment strategy (selective invasive vs. routinely invasive) (section 5.6.2).

Q9: At the weekly cardiology conference of your department, you suggest coronary angiography within 24 h for a high-risk patient presenting with NSTEMI. A colleague challenges you by stating that there is no need to rush and there is no harm to the patient if angiography is carried out within 72 h, as long as there is no symptom recurrence. Is he right?

No, there is evidence showing that the timing of invasive coronary angiography should be individualized based on ischaemic risk. While patients at very high risk (e.g. ongoing ischaemia, haemodynamic instability, recurrent or ongoing chest pain refractory to medical treatment) should undergo immediate (<2 h) coronary angiography, a delay of a maximum of 24 h is appropriate for patients at high risk [i.e. with rise or fall in troponin compatible with MI, dynamic ST or T-wave changes (symptomatic or silent) or Global Registry of Acute Coronary Events (GRACE) score > 140], while for

patients at intermediate risk, a time span of 72 h is recommended (section 5.6.3).

Q10: An 81-year-old patient is admitted because of ongoing chest pain, no ST-segment elevation on ECG and haemodynamic instability (i.e. systolic blood pressure 85 mmHg, heart rate 105 beats per minute). You ask your senior fellow which diagnostic modality he would choose, if he had only one at his disposal, between standard troponin, high-sensitivity troponin, B-type natriuretic peptide or transthoracic echocardiography?

The right answer would be transthoracic echocardiography. In patients with acute heart failure or haemodynamic instability in the setting of suspected NSTEMI-ACS, transthoracic echocardiography should be performed prior to immediate coronary angiography (without waiting on troponin results) to evaluate left ventricular function and exclude non-coronary conditions such as aortic stenosis or massive pulmonary embolism. The assessment of B-type natriuretic peptide adds prognostic information in haemodynamically stable patients but is useless in patients with shock (Figure 1 and section 3.3.4.1).

Q11: A 58-year-old woman with a history of familial hypercholesterolemia and no previous cardiovascular event is admitted to the emergency room (ER) due to typical chest pain. The ECG shows dynamic ST-segment depression in the anterolateral leads and troponin levels are 2.5 times higher than the upper limit of normal. The chest pain lasted for ~25 minutes and the patient became asymptomatic soon after hospital admission. When should this patient be referred for coronary angiography?

This patient fulfils two primary high-risk criteria, namely dynamic ST changes and troponin rise. Therefore she qualifies for an early invasive strategy (<24 h) (section 5.6.3).

Q12: A 68-year-old man with a history of previous CABG is admitted for intermittent typical chest pain to a hospital without an onsite cardiac catheterization facility. ECG is unremarkable and two consecutive blood samples show no elevation of troponin. Should this patient be referred for coronary angiography? If yes, with what delay?

In patients with at least one intermediate risk criterion (for the mentioned patient, history of prior CABG), the invasive strategy may be delayed but should be performed during the same hospital stay, preferably within 72 h of admission. In these patients, urgent transfer to a hospital with onsite catheterization facilities is not necessary, but the 72-h window for coronary angiography should be respected (section 5.6.3).

Q13: A 49-year-old hypertensive man is admitted to a hospital with an onsite cardiac catheterization facility for a single episode of typical chest pain lasting 10 minutes. The patient has no risk factors and his cardiovascular history is unremarkable. ECG is normal and cardiac biomarkers are negative. When should the invasive management be performed in this case?

In low-risk patients (i.e. no recurrence of chest pain, no signs of heart failure, no abnormalities in the initial or subsequent ECG, no rise in troponin

level), a non-invasive assessment of inducible ischaemia may be performed before or shortly after hospital discharge. Coronary angiography should then be performed according to the results of non-invasive testing (section 5.6.3).

Q14: You are convinced that in ACS the transradial approach should be preferred for coronary angiography and PCI, and you believe this applies also for NSTEMI-ACS. A senior interventionalist contradicts you by stating that the benefit of a transradial approach is encountered in ST-elevation MI (STEMI) but not in NSTEMI-ACS. Who is right?

You are right. Indeed, there is large-scale randomized evidence that routine transradial interventions in ACS patients, including patients with NSTEMI-ACS, improve outcomes in terms of lower bleeding and mortality rates as compared with transfemoral interventions. Therefore the transradial approach is recommended in ACS and centres with cardiac catheterization facilities treating patients with ACS should implement a transition to a transradial approach (section 5.6.5.1).

Q15: The fellow is asking you what the evidence is supporting the need for complete revascularization in NSTEMI-ACS patients?

A complete revascularization strategy should be pursued in multivessel disease patients with NSTEMI-ACS based on two considerations. First, several studies showing the benefit of early intervention when compared with the conservative approach in patients with NSTEMI-ACS mandate a complete revascularization strategy. Second, multiple PCI and NSTEMI-ACS trials have shown that incomplete revascularization is associated with worse prognosis compared with complete revascularization (section 5.6.5.3).

Q16: Do the recommended time windows for an invasive strategy (<2 h, <24 h, <72 h) imply that the revascularization should occur within the mentioned delays?

No. The mentioned time windows refer to maximum recommended delays for coronary angiography and not for revascularization. It is recommended to make the decision for a revascularization strategy (i.e. conservative vs. ad hoc culprit lesion PCI vs. multivessel PCI vs. CABG) based on the clinical status and co-morbidities of the patient as well as the CAD severity, according to the local Heart Team protocol. However, this process should not unnecessarily delay revascularization, which should be performed as soon as possible after coronary angiography (section 5.6.3).

Q17: Should a Heart Team discussion take place for every patient presenting with NSTEMI-ACS in the setting of multivessel CAD?

No, PCI of the culprit lesion does not require a case-by-case review by the Heart Team when an ad hoc intervention is indicated based on clinical or angiographic grounds. This is the case for patients with simple disease or requiring immediate revascularization for ongoing or recurrent ischaemia, haemodynamic instability, pulmonary oedema, recurrent ventricular arrhythmias or total occlusion of the culprit coronary artery. Following culprit lesion PCI, and depending on the status of the non-culprit vessels, stabilized NSTEMI-ACS patients with multivessel CAD may undergo a staged PCI or be discussed within the Heart Team, according to institutional protocols.

Q18: A 76-year-old patient with no prior cardiovascular history, but hypertension and smoking as cardiovascular risk factors, is admitted to a hospital without an onsite cardiac catheterization facility for NSTEMI. He is treated with aspirin and ticagrelor at 180 mg loading dose followed by a 90 mg twice-a-day regimen. In the absence of symptom recurrence, the day after admission the patient is transferred to your hospital to undergo a coronary angiogram, which shows three-vessel CAD with involvement of left main stem. The Heart Team proposes CABG. With what delay should surgery take place?

It is recommended that the Heart Team estimate the bleeding and ischaemic risks of the patient and guide the timing of CABG as well as management of dual antiplatelet therapy (DAPT). While in the majority of cases the P2Y₁₂ inhibitor may be safely discontinued prior to surgery, patients who are estimated at high risk for recurrent ischaemic events (i.e., patients with critical coronary anatomy or recurrent ischaemia) should be operated on as soon as possible without waiting for the full recovery of platelet function following discontinuation of DAPT. In this setting, an evaluation of the residual platelet function to guide the timing of surgery may be considered. Since the patient described is stable, ticagrelor can be discontinued and CABG scheduled 5 days later. The same delay of 5 days would be required in patients on clopidogrel, while for patients on prasugrel a 7-day time window before CABG is recommended (section 5.6.6.1).

Q19: Is there a role for an intra-aortic balloon pump in NSTEMI-ACS patients requiring CABG?

An intra-aortic balloon pump may be implanted prior to surgery in patients with ongoing ischaemia despite maximal medical therapy and in those with mechanical complications of MI (i.e. ventricular septal defect or mitral regurgitation due to papillary muscle rupture). Intra- or post-operative insertion of an intra-aortic balloon pump should also be considered in patients requiring major inotropic support (section 5.6.8).

Q20: A 65-year-old patient with NSTEMI and cardiogenic shock is admitted to the ER. The attending physician plans to first stabilize the patient with inotropic drugs for several hours, in order to avoid renal failure associated with contrast, and then refer the patient to coronary angiography. What is your advice?

Immediate coronary angiography (<2 h) is recommended in patients with cardiogenic shock complicating NSTEMI-ACS. The delay to angiography should be reduced to an absolute minimum (i.e., the time to perform transthoracic echocardiography while the anaesthesia team gets arterial and venous lines). PCI is the most frequently used revascularization modality in this setting. Patients with cardiogenic shock and coronary anatomy not suitable for PCI should undergo emergency CABG (section 5.6.8).

Q21: A 79-year-old male patient with NSTEMI has undergone coronary angiography showing two-vessel CAD with involvement of the LAD and RCA. The SYnergy between percutaneous coronary intervention with TAXus and cardiac surgery (SYNTAX) score is 12 and the decision was made to proceed to PCI. Should you prefer the use of a bare metal stent (BMS) over a drug-eluting stent (DES) in this patient, given the advanced age and potential risk of bleeding on DAPT?

No. In the setting of NSTEMI-ACS the recommended duration of DAPT is 1 year, irrespective of the type of stent used. In addition, the use of newer-generation DESs is recommended over BMSs in the elderly. Finally, although no randomized study (DES vs. BMS) has thus far focused on NSTEMI-ACS, NSTEMI-ACS patients have been well represented in the head-to-head stent trials. Based on those results, newer-generation DESs are recommended over BMSs (section 5.6.5.1).

Q22: Do newer-generation DESs play a role in NSTEMI-ACS patients who are at high bleeding risk and in whom prolonged DAPT may not be pursued for a year?

In NSTEMI-ACS patients undergoing DES implantation who are at increased risk of bleeding complications or who have already experienced bleeding complications, DAPT duration may be shortened to 3–6 months (section 5.2.9).

Q23: A 67-year-old female patient with typical chest pain, rise and fall of troponin levels and T-wave inversion in the lateral leads on ECG is admitted. A cardiology fellow asks you whether the management of women with NSTEMI-ACS should be somehow different as compared with men. What is your answer?

There is currently no evidence showing that the treatment of this woman should differ from that of a man with an identical history and clinical presentation. Hence, in NSTEMI-ACS, selection of treatment should depend on the patient's risk profile rather than gender (section 5.7).

Q24: A previously healthy 81-year-old male patient with no prior bleeding events is admitted to the hospital for NSTEMI. Given his advanced age, the cardiologist admitting the patient decides for a conservative treatment strategy and starts DAPT with aspirin and clopidogrel. Does advanced age per se justify a reduced use of more effective P2Y₁₂ inhibitors and limited access to an invasive strategy?

No. Although elderly patients are less likely to receive evidence-based therapies and undergo an invasive strategy as compared with younger patients, they are at greatest risk for adverse events and have been shown to derive appreciable benefits from an invasive management and antithrombotic treatment. Hence the decision not to offer the best possible treatments to this patient (i.e. invasive management and therapy with newer P2Y₁₂ inhibitors) is not supported by the evidence. While treatment with prasugrel in patients ≥75 years of age remains controversial, referring this patient for a coronary angiography and treatment with ticagrelor are better options as compared with conservative management and therapy with clopidogrel (section 5.8.1).

Q25: A 56-year-old patient with a history of non-insulin-dependent diabetes treated with metformin and normal renal function is scheduled for coronary angiography following NSTEMI. Should metformin be discontinued?

In the past, based on concern that accumulation of metformin in patients with reduced renal function may cause lactic acidosis, a routine strategy of metformin discontinuation prior to coronary angiography, irrespective of renal function, has been recommended. Yet, multiple dedicated registries have shown that the incidence of lactic acidosis following coronary angiography, and if required PCI, is extremely low. Therefore it is not recommended to routinely discontinue metformin, but rather to monitor renal

function carefully after angiography/PCI in diabetic patients treated with metformin. In case of deterioration of kidney function, discontinuation of metformin to avoid drug accumulation and possible lactic acidosis is advisable. It remains appropriate to discontinue metformin in patients with reduced renal function prior to coronary angiography (section 5.8.2).

Q26: A 74-year-old male patient with an estimated glomerular filtration rate of 30 mL/min/1.73m² is admitted to the hospital for suspected NSTEMI-ACS. The attending cardiologist starts treatment with aspirin and ticagrelor at an oral bolus dose of 180 mg followed by 90 mg twice a day. The day after, the resident who is in charge of the patient asks you whether the treatment with ticagrelor and the dose are appropriate given the extra bleeding risk observed in the PLATElet inhibition and patient Outcomes (PLATO) trial as compared with clopidogrel. What is your answer?

The choice and dose of antithrombotic drugs need to be carefully evaluated in NSTEMI-ACS patients with chronic kidney disease. While most anticoagulants may need dose adjustment in renal insufficiency, this is not the case for oral antiplatelet agents including prasugrel and ticagrelor. In addition, in the PLATO study patients with impaired renal function derived benefit from ticagrelor as compared with clopidogrel. Therefore the drug and dose are appropriate. It should be noted that both prasugrel and ticagrelor are contraindicated in patients on dialysis (section 5.8.3).

Q27: A 56-year-old troponin-positive patient with no ST elevation on ECG is transferred from a peripheral hospital to your institution for coronary angiography. His prior medical history is unremarkable. He received aspirin and clopidogrel, given at a loading dose of 600 mg followed by 75 mg/day. The diagnostic coronary angiogram shows diffuse CAD but no critical lesion in proximal vessel segments and a conservative strategy is chosen. Does this patient need DAPT? If yes, is clopidogrel appropriate?

Yes, this patient needs DAPT for 1 year (as do all NSTEMI-ACS patients) and no, clopidogrel is not the drug of choice for him. In the PLATO study, clopidogrel was found to be inferior to ticagrelor in ACS patients treated conservatively. Prasugrel would not be an alternative to ticagrelor because in NSTEMI-ACS patients treated conservatively in the Targeted Platelet Inhibition to Clarify the Optimal Strategy to Medically Manage Acute Coronary Syndromes (TRILOGY ACS) trial, prasugrel was not superior to clopidogrel in terms of ischaemic event reduction and it caused more bleeding complications (section 5.2.9).

Q28: A 78-year-old patient with prior MI and hypertension as cardiovascular risk factors is admitted to the hospital for NSTEMI. The attending physician starts treatment with aspirin and prasugrel and schedules coronary angiography for the next day. Is the chosen P2Y₁₂ inhibitor appropriate?

The choice of prasugrel in this patient is not appropriate for two reasons. First, pretreatment with prasugrel in NSTEMI patients scheduled for invasive strategy did not reduce ischaemic events and caused more bleeding complications compared with drug administration at the time of coronary angiography in the Comparison of Prasugrel at the Time of Percutaneous Coronary Intervention or as Pretreatment at the Time of Diagnosis in Patients with Non-ST Elevation Myocardial Infarction (ACCOAST) trial. Second, patients ≥75 years of age may experience a worse efficacy/

safety profile when treated with prasugrel as compared with clopidogrel, as observed in the TRial to Assess Improvement in Therapeutic Outcomes by Optimizing Platelet Inhibition with Prasugrel (TRITON). The P2Y₁₂ inhibitor of choice for the patient would be ticagrelor, because it was found to be superior to clopidogrel in the PLATO study. The optimal timing of administration of ticagrelor (pretreatment vs. administration in the cardiac catheterization laboratory) has not been studied (section 5.2.9).

Q29: A 65-year-old male patient with NSTEMI, a history of hypercholesterolemia and chronic kidney disease undergoes diagnostic angiography showing multivessel CAD. As a general rule, should CABG be preferred over PCI in patients with chronic kidney disease, advanced multivessel disease and low estimated surgical risk?

Yes. In the absence of prospective randomized data, registry data suggest a mortality advantage of CABG over PCI in patients with the mentioned characteristics. However, none of those studies has been conducted in the setting of NSTEMI-ACS. Hence clinical presentation (e.g. absence of recurrent symptoms vs. ongoing ischaemia vs. haemodynamic instability) as well as co-morbidities and the extent of CAD remain of paramount importance in the choice of the revascularization modality in individual patients with chronic kidney disease (section 5.8.3).

Q30: A 71-year-old woman with a history notable for insulin-dependent diabetes undergoes diagnostic angiography because of NSTEMI-ACS. The angiogram shows multivessel CAD. As a general rule, should CABG be preferred over PCI in patients with diabetes mellitus, advanced multivessel disease and low estimated surgical risk?

Yes, meta-analyses of randomized controlled trials suggest a mortality advantage of CABG over PCI in patients with multivessel CAD and low surgical risk. However, paralleling the observation just made for patients with chronic kidney disease, no contemporary trial has investigated PCI vs. CABG in diabetic patients with NSTEMI-ACS. Hence clinical presentation as well as co-morbidities and the extent of CAD remain of paramount importance in the choice of the revascularization modality in individual diabetic patients (section 5.8.2).

Q31: A patient is admitted to the hospital because of paroxysmal atrial fibrillation, which responds quickly to pharmacological cardioversion. During the tachycardia, the patient complained of a vague chest discomfort. In sinus rhythm he is completely asymptomatic and has a good exercise capacity. Yet, a mild troponin elevation is noted a few hours after sinus rhythm restoration. Should this patient undergo invasive coronary angiography?

Troponin elevation per se is not sufficient for the diagnosis of MI. According to the universal definition of MI, at least one additional criterion is required, e.g. typical ischaemic symptoms or ischaemic ECG changes. In addition, in the presence of poorly controlled ventricular rate during atrial fibrillation, troponin elevation may be secondary to a myocardial oxygen supply/demand mismatch (type 2 MI) and may not be related to plaque rupture. Therefore routine invasive management in patients with the mentioned presentation is not indicated (section 5.8.5).

Q32: A 56-year-old woman weighing 47 kg was transferred from a peripheral hospital for coronary angiography for

ongoing myocardial ischaemic symptoms. She has no history of bleeding or cardiac diseases. Upon arrival, she complained about ongoing typical chest pain in the absence of ST-segment elevation on 12-lead ECG. She received prasugrel 60 mg orally in addition to aspirin 250 mg intravenously 1 h before arrival at the tertiary centre, but she vomited multiple times in the ambulance. She underwent immediate coronary angiography, revealing an occluded LCX, which was successfully reopened with the implantation of a DES after the administration of unfractionated heparin. What about P2Y₁₂ inhibitor administration following PCI?

Administration of prasugrel prior to coronary angiography in NSTEMI-ACS patients undergoing early invasive strategy is contraindicated based on the results of the ACCOAST trial. Following PCI, a P2Y₁₂ inhibitor reloading strategy seems reasonable, based on the multiple episodes of vomiting shortly after drug administration. Given the low body weight of the patient (< 60 kg), if it is decided to pursue prasugrel, following the loading dose, the maintenance dose should be reduced 5 mg/day (instead of 10 mg/day). However, this regimen has never been properly tested in the PCI setting. Therefore ticagrelor is the most appropriate option for this patient, with a 180 mg loading dose administered following PCI followed by the standard 90 mg twice-a-day regimen for 1 year (section 5.2.9).

Q33: An 83-year-old patient with NSTEMI undergoes invasive coronary angiography, which shows complex three-vessel CAD without involvement of the left main coronary artery. The SYNTAX score is 33. The patient is stable at the time of angiography, symptom-free and coronary flow is normal in all vessels. How and when should this patient be revascularized?

The guidelines reinforce the importance of the Heart Team in the choice of the revascularization modality in patients with advanced multivessel disease. In cases of haemodynamic instability or evidence of ongoing ischaemia, it is paramount to rely on the quickest available revascularization modality, which is frequently PCI (if feasible), in order to stabilize the patient's condition and relieve ongoing ischaemia. In the patient mentioned, it is advisable to postpone revascularization following Heart Team discussion. Each institution is encouraged to have written management protocols, developed in agreement with major stakeholders, including non-invasive and interventional cardiologists as well as cardiac surgeons and anaesthesiologists, which may obviate the need of systematically postponing revascularization in cases where a common agreement among parties can be anticipated (section 5.6.7).

Q34: A 45-year-old patient with a history of insulin-dependent diabetes mellitus is admitted to the hospital because of NSTEMI-ACS. Coronary angiography shows two-vessel CAD, which is treated by PCI with DES implantation. Should diabetes per se drive the preferential selection of a specific type of P2Y₁₂ inhibitor in cases of NSTEMI-ACS?

No. It is recommended to administer antithrombotic treatment as in non-diabetic patients. Poor responsiveness to clopidogrel has been shown to be more prevalent in patients with diabetes mellitus, and both newer P2Y₁₂ inhibitors have been shown to be consistently superior to clopidogrel in patients with diabetes. Hence prasugrel and ticagrelor are both preferable to

clopidogrel in NSTEMI-ACS patients, irrespective of the presence of diabetes mellitus (section 5.8.2).

Q35: A patient presenting with acute heart failure and NSTEMI undergoes invasive coronary angiography, which shows a thrombus-containing flow-limiting lesion in the proximal LAD and a chronic occlusion of both the LCX and RCA. How should this patient be treated?

Definitely this patient is at extremely high risk and immediate revascularization is needed. A Heart Team discussion should take place in the cardiac catheterization laboratory as soon as the diagnostic angiography is finished. Depending on age, co-morbidities and left ventricular function, the patient may be deemed to be at too high risk for CABG. In this case, PCI should be performed, keeping in mind that, in case of distal embolization or other complication in the culprit vessel, the patient may suffer major haemodynamic instability and even cardiac arrest. Therefore the anaesthesia team should be present at the time of PCI.

Q36: Should the implantation of an intra-aortic balloon pump before or during PCI be considered for the patient just described?

Although circulatory support has not been adequately studied in this setting, an intra-aortic balloon pump may be considered as adjunctive to stabilize the patient and safely perform LAD revascularization. Alternatively, short-term mechanical circulatory support [e.g., extra-corporeal membrane oxygenator (ECMO)], if available, may be considered (section 5.6.8).

Q37: A 71-year-old female patient known to suffer from immune thrombocytopenia is admitted for high-risk NSTEMI. The actual platelet count at admission is 34 000/ μ L, which is confirmed by a second lab test. Renal function is normal. Which anticoagulant drug should this patient receive in order to minimize the risks of a subsequent platelet count decrease?

The anticoagulant options that would carry the lowest probability of further reducing the platelet count are fondaparinux and bivalirudin prior to coronary angiography and bivalirudin in the catheterization laboratory. However, due to increased risk of bleeding, it might be reasonable to expedite an invasive assessment, preferably from a transradial approach, to guide antithrombotic treatment and to avoid exposing this high-risk patient to possibly unnecessary antithrombotic therapy (section 5.8.7).

Q38: What should be the optimal antiplatelet regimen for the patient just described in case a PCI is required?

There is currently no evidence to guide the most appropriate antiplatelet therapy in this case, as patients with thrombocytopenia have been systematically excluded from randomized controlled studies comparing different antiplatelet agents. Since the bleeding risk is increased in patients with a low platelet count, an initial strategy based on aspirin and clopidogrel seems reasonable (section 5.8.7).

Q39: A patient with NSTEMI who has recently undergone DES implantation has rheumatoid arthritis currently requiring non-steroidal anti-inflammatory drugs (NSAIDs) because of a relapse of the disease. He has read in the newspaper that those drugs may put him at risk. Is this true?

Yes. NSAIDs (both coxibs and traditional NSAIDs) increase cardiovascular risk. Evidence of increased risk appears early, as suggested by short-term trials of coxib therapy among patients undergoing CABG, and is not attenuated by concomitant aspirin use. Therefore exposure to NSAIDs should be minimized or avoided, if possible, in patients with established CAD, especially in the setting of a recent MI (section 5.8.8).

Q40: A patient with NSTEMI underwent multiple stent implantations. He received a glycoprotein IIb/IIIa inhibitor bolus and infusion during PCI because of a large thrombus seen on angiography. Four hours after intervention, his platelet count has decreased (from 278 000/ μ L to 110 000/ μ L). What safety measure should be implemented in this scenario?

It would be appropriate to immediately confirm the low platelet count on citrate tubes to rule out false thrombocytopenia. If confirmed, stopping glycoprotein IIb/IIIa inhibitor infusion is recommended (indications: platelet count falls to $<100\,000/\mu\text{L}$ or drops by $>50\%$ from baseline). Close monitoring of the platelet count and for signs of bleeding is indicated (section 5.2.7).

Reference

Full text document: Roffi M, Patrono C, Collet J-P, Mueller C, Valgimigli M, Andreotti F, Bax JJ, Borger MA, Brotons C, Chew DP, Gencer B, Hasenfuss G, Kjeldsen K, Lancellotti P, Landmesser U, Mehilli J, Mukherjee D, Storey RF, Windecker S. 2015 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation. *Eur Heart J*. doi: 10.1093/eurheartj/ehv320. Available at <http://www.escardio.org/guidelines> and <http://eurheartj.oxfordjournals.org>.