CLINICAL GUIDELINES FOR ACUTE CORONARY SYNDROME (ACS)

ACS Clinical Advisory Group

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Final Version

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Preface

The burden of Ischemic heart disease (IHD) is on the rise globally and is the main cause for morbidity and mortality.(1) In the Kingdom of Saudi Arabia, IHD is a significant cause of mortality, and its burden is increasing due to the high prevalence of cardiovascular risk factors.(2, 3)

Recent national and regional registries have provided key insights about the mode of presentation of Acute Coronary Syndrome (ACS) in Saudi patients, the treatments received, as well as short and long-term outcomes. A key finding was that ACS seems to present ten years earlier in the Saudi population compared to their counterparts in the west.(4) Moreover, a third of ACS patients present with ST-Elevation Myocardial Infarction (STEMI), while the remaining two thirds present with Non-ST Elevation Acute Coronary Syndrome (NSTE-ACS).(4, 5) In a recent report, only 42% of STEMI patients underwent primary PCI (PPCI), and of those only 62% achieved a door to balloon time below 90 minutes.(6) An alarming finding was that around a third of all STEMI patients do not receive any form of reperfusion therapy.(6) In this group of patients, more than half did not receive it because they presented late to a hospital. Additionally, most patients self-transport to the nearest emergency department, and less than 5% of patients are transferred via emergency medical services (EMS). (7)

Guidelines recommend PPCI as the preferred reperfusion strategy for STEMI patients if performed within 90 minutes of first medical contact (FMC), and if transferred from a medical facility provided that FMC to device time is less than 120 minutes inclusive of inter-hospital transfer time.(8) A network-based model with organised multidisciplinary **c**ritical pathways for ACS emergency care effectively decreases disparities in the event-to-facility transfer duration and increases the achievement of timely FMC to device time with concomitant reductions in morbidity and mortality.(9)

An opportunity exists for the development of an effective ACS providers network supported by up-to-date agreed on clinical practice guidelines and standards, provider and institutional certification, effective ancillary support infrastructure such as effective communication, as well as a strong local EMS services that meet recognised ACS standards in the timely transfer to an appropriate facility. Such networks will be must be supported by adequate

workforce training, and financial reimbursement mechanisms that incentivises delivery of care that is value-based.

It is well recognised that a key component of any strategy to reduce morbidity and mortality from ACS is prevention, therefore, effective post-discharge risk factor control and the availability of cardiac rehabilitation services need to be insured and integrated with the other parts of the pathway, to provide seamless end-to-end services.

The primary objective of the new ACS pathway in Saudi Arabia will be to reduce the time between the onset of cardiac symptoms and the start of standard clinical interventions while reducing the occurrence of unwarranted variations in care delivery.

This document presents clinical guidelines aimed at helping frontline practitioners in the management of a typical ACS patient. Furthermore, these guidelines have been developed to support and guide the rollout of new national ACS networks, and to provide a framework that will support the development and implementation of dedicated ACS services using fit-for-locality networked provider models across the different regions of Saudi Arabia. Additionally, these clinical guidelines will help health system administrators, care/pathway commissioners (service payers), and service providers judge the quality of their local services and plan for the improvements as needed.

To that end, a multi-disciplinary Clinical Advisory Group (CAG) was assembled to develop this document. The work dedicated to developing these clinical guidelines was extensive, and involved a considerable amount of time in the search and critical appraisal of various international clinical guidelines and the evidence that underpins them. It's important to emphasize that these guidelines were not created de-novo but were rather adopted from selected international guidelines. Nonetheless, with few exceptions, we have attempted to adapt and contextualize some of the international guidelines to local needs.

Many people have been involved through providing valuable feedback as well as help in the production of this document. We would like to extend our gratitude to Professor Hadley Wilson, who provided critical appraisal of this document. These guidelines reflect all of the knowledge, perspectives, and efforts put forth by a wide group of people.

This document marks a critical point in our journey towards improving ACS care in Saudi Arabia, but a long way awaits us. The biggest challenge beyond the development of national guidelines for ACS is to implement them; therefore the hard work of standardizing clinical care of ACS patients effectively starts after the development of this document.

On behalf of the members of the CAG, who have volunteered their time outside of their day jobs to achieve this important milestone in the care of ACS patients, and the many people who aided them, I hope that this work would make a difference in improving the care of ACS patients in Saudi Arabia.

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Contributions

Contributions from diverse stakeholders to the development of this guidelines document are noted with gratitude. This work would not have been completed without the contributions from the members of the Clinical advisory group. The members of the development group include:

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External review of the document was provided by Professor Hadley Wilson, Professor of Medicine at the Sanger Heart & Vascular Institute, Carolinas HealthCare System/Atrium Health, American College of Cardiology.
In addition, support from ACS team members including Bader Khalifah Alsharif, Maria Stavridou and Victoria Hughes is noted.

Introduction

The term ACS encompasses a range of conditions from NSTE-ACS to STEMI, arising from thrombus formation on a ruptured atheromatous plaque.
These guidelines attempt to address the typical ACS patient journey from onset of symptoms, through to when a firm diagnosis has been made, acute hospital care, and care at discharge from hospital and beyond to address secondary prevention.

Left untreated, the prognosis of patients with ACS is poor, and mortality is high, particularly in people who have had myocardial damage. It is important to undertake appropriate triage, risk assessment and instigate timely use of acute pharmacological or invasive interventions, if future adverse cardiovascular events (e.g. myocardial infarction, stroke, repeat revascularization or death) are to be prevented.

These guidelines do not cover the management of certain complications arising from ACS such as cardiac arrest, atrial fibrillation, or acute heart failure, since providing guidance on these conditions are not within the scope of the current guidelines, and because these conditions deserve a separate focus. The guidelines were developed in response to the need to standardize the care of ACS patients. This need became more pressing with the establishment of the ACS pathway in Riyadh region. The pathway is a national transformation program initiative, which will be initially piloted in Riyadh region, then scaled to other regions in Saudi Arabia. Our aim is to summarize best practices in the care of adults with a diagnosis of STEMI or NSTE-ACS, based on review of international guidelines and best practices. They are not in any way a substitute to the health practitioner's individual responsibility to make appropriate and accurate decisions in consideration of each patient's health condition and in consultation with that patient and his caregiver, where appropriate. It is also the health practitioner's responsibility to refer to the rules and regulations applicable to drugs and devices at the time of prescription, to inform decisions made with individual patients.

Value-based healthcare

In order to deliver value in healthcare provision, treatment and care should take into account patients' needs and preferences. Patients with ACS should have the opportunity to make informed decisions about their care and treatment, in partnership with their healthcare professionals. These decisions should be supported by the best evidence tailored to the patient's own needs, and should be properly communicated and culturally appropriate. Care options and the information patients are given about it, should also be accessible to people with additional needs such as physical, sensory or learning disabilities, and to people who do not speak or read Arabic. If patients do not have the capacity to make decisions, healthcare professionals should discuss care options with the patient's family wherever possible.

Once care is delivered, it is important to measure outcomes that matter to patients. A clear understanding of the patient's aims of therapy would facilitate the achievement of the desired outcomes of care. Finally, it is critical to target the desired clinical outcomes while measuring the cost of care delivered during the full journey of care. Better care with lower cost is the cornerstone of value-based healthcare, and constitutes the true north of the new ACS pathway that will be implemented in Saudi Arabia. The agreement on national Clinical practice guidelines is key in reducing unwarranted care variations, and is the first step in the path towards achieving a value-based care for ACS patients.

Our approach in adopting clinical guidelines for acute coronary syndrome

Knowing that there are numerous internationally recognized guidelines for ACS, the ACS pathway team undertook an internet-based review of guidelines from across the world. These guidelines were documented into an excel spreadsheet and further analysis across the guidelines were undertaken to identify commonalities. This data was collated, and the spreadsheet containing these various guidelines were reviewed and analyzed by the CAG members.

The CAG members agreed that the best approach for the adoption process was to breakdown the patient journey into four key components or decision stops. The first decision stop starts from the onset of ischemic symptoms, typically chest pain, along with the initial assessment in the emergency department or by the paramedics if the patient is transported by emergency medical services (EMS). Following the initial assessment of ischemic symptoms, the second and third decision stop would follow either of two critical paths based on the initial ECG: STEMI or a NSTE-ACS. The fourth decision stop of the journey is hospital care beyond the acute phase. The hallmark of this phase is maintenance therapies, monitoring, diagnostic work-up, discharge planning, and beyond discharge including long-term follow up, risk reduction and cardiac rehabilitation customized to patient's needs. It was recognized that there would be some degree of overlap between these four key decision stops. The CAG members were assigned into four separate focus groups, and each group was assigned a decision stop to address the expected diagnostic and therapeutic situations that a practitioner is often faced with.

For each of the four decision stops, the scope and the expected needs of a typical ACS patient was determined. Further, clinical questions around these needs were formulated, and each group then sought answers to these questions from international ACS guidelines. The CAG members agreed on a set of guiding principles in their work to adopt from international guidelines. These guiding principles were not only used in the adoption process, but also to resolve potential disagreements about the adoption of an individual

guideline item, its customization to local realities, or the wording of the guidance. Seven guiding principles were agreed on:

1. The most recent guidelines are the initial and primary source for adoption.
2. Individual guidelines are to be adopted based primarily on the strength of the guidance and quality of evidence that the guidance is based on as possible.
3. Avoid areas of potential controversy and where evidence is still evolving.
4. Suitability to the local context
5. Priority is given to common clinical scenarios faced by practitioners working in Saudi Arabia.
6. Select guidelines that are both practical and simple in their logic and wording. This is to increase the likelihood of uptake and implementation by local practitioners.
7. Avoid ACS population sub-groups (e.g. Acute heart failure, Atrial fibrillation, complete heart blocks…etc), and focus on the core elements of the typical ACS patient journey. These sub-groups of patients deserve dedicated guidance, and as such they are outside the scope of the ACS guidelines.

The groups assigned to different ACS patient decision stops were asked to review and identify guidelines for inclusion, and document proposed guidelines into an agreed-on template. Guidelines were formulated to address clinical situations at these different decision stops, and were then collated into an on-line survey for all CAG members to review and score using a 5-point Likert scale to generate consensus. The CAG members then held several workshops, as well as multiple videoconferences to review the survey results. Guidelines that received a high level of agreement were included. In some cases, some re-wording was employed, to ensure relevance to the Saudi context or to further simplify the language. Individual guidelines with a low degree of agreement were either deferred for further discussion after more research was undertaken or were excluded. Feedback and decisions were noted, and agreed guidelines collated into a single document.

The final guideline document was then sent to the CAG members for a final round of validation, and then sent to a group of local and international experts for external validation.

ACS Guidelines

Chest pain assessment and therapies

Early diagnosis and treatment of ACS in general and STEMI in particular, is essential if reduced mortality and morbidity is to be achieved. The guidelines in the sections below are aimed to give a summary of what first medical contact (FMC) should be doing at each stage of the pathway.

Pre-hospital

Diagnosis and initial therapies

Pre-hospital phase includes patients that come to the hospital via Emergency Medical Services (EMS).

Clinical Situation: Pre-hospital ECG in patients with suspected ACS

Guidance:

- It is recommended that ambulance teams are trained and equipped to identify STEMI (**with the use of ECG recorders and telemetry as necessary**) and administer initial therapy, based on best evidence.(10)
- We recommend that EMS personnel acquire an ECG in the field to identify STEMI and alert STEMI care teams of an imminent patient arrival.(8)

Clinical Situation: Pre-hospital Therapies

Guidance:

- Aspirin is recommended as soon as possible for all patients without contraindications. The recommended loading dose of Aspirin is 150-300 mg orally.(10)
- Recommend avoidance of routine intravenous opioid analgesic (e.g., morphine or fentanyl) administration for STEMI-related discomfort. However, selective use of opioid analgesic medications may be considered for severe pain with the goal of relieving pain and reducing anxiety.(8)
- It is recommended to avoid routine pre-hospital administration of supplemental oxygen to STEMI patients with oxygen saturation ≥ 90%. (8)

Transport of diagnosed STEMI patients

Clinical Situation: Transport of STEMI patients diagnosed at the pre-hospital stage

Guidance:

- If primary percutaneous coronary intervention (PPCI) is used as a default strategy for suspected STEMI, it is recommended that patients should bypass non-PCI capable centers and be transported directly to the nearest PCI capable center. (8)
- The goal is to achieve a target first medical contact (FMC)-to-device time of ≤120 minutes (ideal FMC-to-device time ≤ 90 minutes in urban settings). Fibrinolytic therapy should be considered if this timeline couldn't be achieved.(8)

- It is recommended that patients transferred to a PCI-capable center for PPCI, bypass the emergency department and CCU/ICCU, and are transferred directly to the cardiac catheterization laboratory. (10)

Emergency Department (ED)

Diagnosis

In Saudi Arabia more than 95% of patients suspected of having ACS self-present to the hospital with chest pain.(4) When this happens, it is essential that early investigation and diagnosis of chest pain immediately upon arrival to the emergency department is established, so that prompt and appropriate treatment can be initiated.

Clinical Situation: Timing of ECG performance in ED stage

Guidance:

- A 12-lead ECG recording, and interpretation is indicated as soon as possible at the point of FMC, with a maximum target delay of 10 min.(10)

Clinical Situation: Is risk stratification necessary in patients with suspected ACS?

Guidance:

- Patients with suspected ACS should be risk stratified based on the likelihood of ACS and adverse outcome(s) to decide on the need for hospitalization and assist in the selection of treatment options.(11)
- We recommend using the HEART score in the risk stratification of suspected ACS patients.

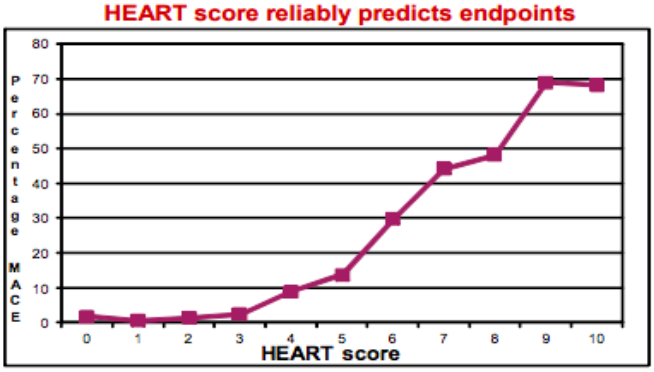
The HEART Score

The HEART score is a risk assessment tool that helps triage patients presenting with chest pain. This risk tool can help stratify patients based on their short-term MACE risk. In adult patients without evidence of ST-elevation ACS, the History, ECG, Age, Risk factors, Troponin and HEART score can be used as a clinical prediction instrument for risk stratification. A low score (<3) predicts 30-day MACE miss rate within a range of 0% to 2%.(12)

HEART score for chest pain patients in the ED.

Variable	Features	Points
History	• Highly suspicious • Moderately suspicious • Slightly or nonsuspicious	• 2 • 1 • 0
ECG	• Significant ST-depression • Nonspecific repolarization • Normal	• 2 • 1 • 0
Age, y	• ≥65 • >45 to <65 • ≤45	• 2 • 1 • 0
Risk factors (diabetes mellitus, smoker, hypertension, hypercholesterolemia, family history of coronary artery disease, obesity, history of significant atherosclerosis)	• ≥3 risk factors or history of atherosclerotic disease • 1 or 2 risk factors • No risk factors	• 2 • 1 • 0
Troponin	• ≥3×normal limit • >1 to <3×normal limit • ≤Normal limit	• 2 • 1 • 0

HEART score reliably predicts endpoints



HEART	~ % pts	MACE/n	MACE	Death	Proposed Policy
0-3	32%	38/1993	1.9%	0.05%	Discharge
4-6	51%	413/3136	13%	1.3%	Observation, risk management
7-10	17%	518/1045	50%	2.8%	Observation, treatment, CAG

*MACE = Major Adverse Cardiac Event = Myocardial Infarction, PCI/CABG, all-cause death. Based on N=6174

Initial therapies

Clinical Situation: In patients who are diagnosed with STEMI in the ED, what is the evidence for using oral or IV beta-blockers?

Guidance:

- Intravenous beta-blockers must be avoided in patients with hypotension, acute heart failure or AV block, or severe bradycardia.(10)

Management of STEMI patients:

Reperfusion therapy

Clinical Situation: Decisions regarding Primary PCI for STEMI patients

Guidance:

- Reperfusion therapy is indicated in all patients with symptoms of ischemia of ≤12 h duration and persistent ST-segment elevation, (see below timeframe table). (8)
- A PPCI strategy is preferred over fibrinolysis if the recommended time frames are met.(10)
- We recommend that STEMI networks target a total FMC-to-device time (including inter-facility transfer) of ≤120 minutes. Fibrinolysis should be considered if this timeline couldn't be achieved. (8)
- We recommend that the time between registration of patient at non-PCI-capable hospital and patient leaving a non-PCI-capable hospital via EMS (Door-in to Door-out Time [DIDO]) of ≤30 Minutes.(8)
- We recommend a target FMC-to-device time ≤ 90 minutes when a patient presents to the emergency department of a PCI-capable centre. (8)
- For patients with a contraindication to fibrinolysis, transfer for PPCI should be initiated even if the FMC-to-device time is expected to be greater than 120 minutes. (8)
- A routine primary PCI strategy should be considered in patients presenting late (12–48 h) after symptom onset.(10)
- In asymptomatic patients, routine PCI of an occluded IRA >48 h after onset of STEMI is not indicated.(10)

Clinical Situation: Recommended timeframes for the diagnosis and management of STEMI patients

Guidance: The table below show the recommended time frames for diagnosis and management of STEMI patients undergoing mechanical reperfusion therapy. (8)

METRIC	**GOAL** ***(Regional goal: ≥75% of cases to achieve each metric)***
First Medical Contact (FMC) to Diagnosis (ECG acquisition & interpretation)	≤10 Minutes
Diagnosis to Catheterization Lab Activation	≤10 Minutes
Door-in to Door-out Time for Emergency Departments	≤30 Minutes
Transport Times for Inter-Hospital Transfers or STEMI patients diagnosed in the field	≤60 Minutes
Time from arrival at catheterization lab to first device activation	≤30 Minutes
Total time from FMC to first device activation (for primary PCI)- for non-PCI-capable center or patients diagnosed in the field	≤120 Minutes
Total time from FMC to first device activation (for primary PCI) - for patients presenting to PCI-capable centers	≤90 Minutes
Time delay from start of fibrinolysis to angiography (if fibrinolysis is successful)	2-24 hours

Clinical Situation: Conditions where Fibrinolysis should be considered in STEMI patients

Guidance:

- If timely primary PCI cannot be performed after STEMI diagnosis, fibrinolytic therapy is recommended within 12 h of symptom onset in patients without contraindications.(10)

- A fibrin-specific agent (i.e. Tenecteplase, Alteplase, or Reteplase) is recommended.(10)
- We recommend that timely fibrinolysis (in a hospital without PCI capability) followed by a pharmaco-invasive strategy could be considered as an alternative to primary PCI for patients who are early presenters (symptom onset <3 hours), who are at low risk of bleeding and who cannot undergo rapid primary PCI.(8, 13)
- If a pharmaco-invasive strategy is planned, we recommend a target time of ≤ 30 minutes between FMC to bolus or infusion start of Fibrinolysis. (8, 10)
- We recommend routine immediate transfer to PCI centres after fibrinolysis, immediate PCI for patients with failed reperfusion*****, and routine angiography +/- PCI within 24 hours after successful fibrinolysis.(8)

***Practical tip:(8, 10)**

- Failed reperfusion following fibrinolysis is defined as failure to achieve > 50% ST-segment resolution in the ECG lead with maximal ST elevation, and/or persistent chest pain or hemodynamic or electrical instability 60-90 minutes after the initiation of fibrinolysis
- A half dose of fibrinolytic therapy may be considered for patients undergoing a pharmacoinvasive strategy who are older than 75 years of age.
- For patients with a contraindication to fibrinolysis, transfer for PPCI should be initiated even if the FMC-to-device time is expected to be > 120 minutes.

Clinical Situation: Observation requirements of patients diagnosed with a STEMI

Guidance:

- It is recommended that patients presenting to a non-PCI-capable hospital and awaiting transportation for primary or rescue PCI are attended in an appropriately monitored area (e.g. the emergency department, CCU/ICCU, or intermediate care unit).(10)
- It is indicated that all hospitals participating in the care of STEMI patients have a CCU/ICCU equipped to provide all aspects of care for STEMI patients, including treatment of ischemia, severe heart failure, arrhythmias, and common comorbidities.(10)

Clinical Situation: Should all STEMI patients who are successfully re-perfused after fibrinolytic therapy, undergo angiography?

Guidance:

- Angiography and PCI of the IRA, if indicated, is recommended between 2 and 24 hours after successful fibrinolysis.(10)

Clinical Situation: What is the preferred vascular access, for PPCI patients?

Guidance:

- Radial access is recommended over femoral access if performed by an experienced radial operator.(10)
- In centres experienced with radial access, a radial approach is recommended for coronary angiography and PCI.(8)

Clinical Situation: The use of percutaneous Left Ventricular assist devices

Guidance:

- Routine intra-aortic balloon pumping is not indicated.(10)

Clinical Situation: In STEMI patients with multi-vessel disease, should all non-infarct related arteries (IRA) be revascularized?

Guidance:

- Routine revascularization of non-IRA lesions should be considered in patients with multi-vessel disease before hospital discharge.(14)

Clinical Situation: In a STEMI patient, should Thrombectomy devices be used routinely?

Guidance:

- Routine use of thrombus aspiration as an upfront strategy is not recommended.(8, 14)

Clinical Situation: In STEMI patients with cardiogenic shock, what is the optimum treatment strategy?

Guidance:

- Immediate PCI is indicated if coronary anatomy is suitable and undertaken <120 min. Fibrinolysis should be considered in patients presenting with cardiogenic shock if a primary PCI strategy is not available within 120 min from STEMI diagnosis and mechanical complications have been ruled out. If mechanical complications are present, these should be treated as early as possible.(10)

Clinical Situation: In STEMI patients with cardiogenic shock and multi-vessel disease, should routine revascularization of the non-IRAs be performed?

Guidance:

- In cardiogenic shock, routine revascularization of non-IRA lesions is not recommended during primary PCI.(14)

Clinical Situation: In STEMI patients, when should coronary artery bypass grafting (CABG) be considered for revascularization of the IRA?

Guidance:

- CABG should be considered in patients with on-going ischemia and large areas of jeopardized myocardium if PCI of the IRA cannot be performed.(10)

Clinical Situation: In asymptomatic patients with late presentation STEMI, should the IRA be opened?

Guidance:

- A routine primary PCI strategy should be considered in patients presenting late (12–48 h) after symptom onset.(10)
- In asymptomatic patients, routine PCI of an occluded IRA >48 h after onset of STEMI is not indicated.(10)

- In patients with late presentation STEMI and Hemodynamic instability, PCI should be considered regardless of the time frame

Adjunctive therapy in the setting of reperfusion therapy

Clinical Situation: Preferred Dual antiplatelet therapy in patients undergoing Primary PCI?
Guidance:

- Aspirin is recommended as soon as possible for all patients without contraindications. The recommended loading dose of Aspirin is 150-300 mg orally. (10)
- Ticagrelor (Loading dose 180 mg orally, followed by 90 mg twice/day for 12 months) or Clopidogrel if Ticagrelor is not available (Clopidogrel Loading dose 600 mg orally, followed by 75 mg once/day for 12 months), is recommended before or at latest at the time of PCI and maintained over 12 months, unless there are contraindications such as excessive risk of bleeding. (10)

Clinical Situation: Preferred Dual antiplatelet therapy in patients receiving fibrinolysis
Guidance:

- Aspirin is recommended as soon as possible for all patients without contraindications. The recommended loading dose of Aspirin is 150-300 mg orally. (10)
- Clopidogrel is indicated in addition to aspirin. Clopidogrel loading dose is 300 mg orally, followed by 75 mg once/day for 12 months (in patients ≥75 years of age, the loading dose is 75 mg followed by 75 mg once/day for 12 months)(10)

Clinical Situation: Preferred anticoagulant therapy in patients undergoing Primary PCI
Guidance:

- We recommend routine use of unfractionated heparin (UFH) for procedural anticoagulation in patients with STEMI undergoing primary PCI.(8)

Clinical Situation: Preferred anticoagulant therapy in patients receiving Fibrinolysis
Guidance:

- Enoxaparin I.V. followed by S.C. is preferred over Unfractionated heparin (UFH).(10)
- UFH is given as a weight-adjusted I.V. bolus followed by infusion if Enoxaparin is not available. (10)

Hospital management and discharge planning

Clinical Situation: Monitoring requirements following the acute phase of STEMI diagnosis and during hospitalization
Guidance:

- It is indicated that all STEMI patients have ECG monitoring for a minimum of 24 h.(10)
- It is indicated that patients with successful reperfusion therapy and an uncomplicated clinical course are kept in the CCU/ICCU for a minimum of 24 h whenever possible, after which they may be moved to a step-down monitored bed for an additional 24–48 h.(10)

Clinical Situation: Same day transfer to a Non-PCI capable hospital for further monitoring and management

Guidance:

- Same day transfer should be considered appropriate in selected patients after successful primary PCI, (i.e. those without on-going myocardial ischemia, arrhythmia, or hemodynamic instability, not requiring vasoactive or mechanical support, and not needing further early revascularization).(10)

Clinical Situation: Recommendations regarding imaging and stress testing in STEMI patients during the hospital stay

Guidance:

- Routine echocardiography to assess resting LV and RV function, detect early post-MI mechanical complications, and exclude LV thrombus is recommended in all patients.(10)
- Emergency echocardiography is indicated in hemodynamically unstable patients.(10)

Clinical Situation: Therapy of acute heart failure patients in the context of a Myocardial Infarction

Guidance:

- ACE inhibitor (or if not tolerated, ARB or ARNI) therapy is indicated as soon as hemodynamically stable for all patients with evidence of LVEF ≤40% and/or heart failure, to reduce the risk of hospitalization and death.(10)
- Beta-blocker therapy is recommended in patients with LVEF ≤40% and/or heart failure after stabilization, to reduce the risk of death, recurrent MI, and hospitalization for heart failure.(10)
- Mineralocorticoid receptor antagonist (MRAs) are recommended in patients with an LVEF <_40% and heart failure or diabetes, who are already receiving an ACE inhibitor and a beta-blocker, provided there is no renal failure or hyperkalemia, and that the patients would receive close monitoring of the potassium after discharge.*(10)
- Oxygen is indicated in patients with pulmonary oedema with SaO2 <90% to maintain a saturation >95%.(10)

*Practical tip:

- Check renal function and electrolytes (particularly K+).
- Start with a low dose (see above).
- Consider dose up-titration after 4–8 weeks.
- Check blood chemistry at 1 and 4 weeks after starting/increasing dose and at 8 and 12 weeks; 6, 9, and 12 months; 4-monthly thereafter.
- If K+ rises above 5.5 mmol/L or creatinine rises to 221 µmol/L (2.5 mg/dL)/eGFR <30 mL/min/1.73 m2, halve dose and monitor blood chemistry closely.
- If K+ rises to >6.0 mmol/L or creatinine to >310 µmol (3.5 mg/dL) eGFR <20 mL/min/1.73 m2, stop MRA immediately and seek specialist advice.
- A specialist HF nurse may assist with education of the patient, follow-up (in person or by telephone), biochemical monitoring, and dose up-titration.

Clinical Situation: Management of STEMI patients with stable or hemodynamically irrelevant ventricular arrhythmias

Guidance:

- Prophylactic treatment with antiarrhythmic drugs is not indicated and may be harmful.(10)
- Asymptomatic and hemodynamically irrelevant ventricular arrhythmias should not be treated with antiarrhythmic drugs.(10)

Clinical Situation: The long-term management of ventricular arrhythmias and risk evaluation for sudden death

Guidance:

- ICD therapy is recommended to reduce sudden cardiac death in patients with symptomatic heart failure (NYHA class II–III) and LVEF ≤35% despite optimal medical therapy for >3 months and 6 weeks after MI, who are expected to survive for at least 1 year with good functional status.(10)

Clinical Situation: Recommended antiplatelet therapy at discharge from Hospital

Guidance:

- Aspirin (81–162 mg/day) should be continued indefinitely unless it is not tolerated or an indication for anticoagulation becomes apparent.(10)
- Clopidogrel should be prescribed if aspirin is contraindicated.(10)
- DAPT in the form of aspirin plus Ticagrelor, or Clopidogrel, if Ticagrelor is not available, is recommended for 12 months after PCI, unless there are contraindications such as excessive bleeding. (10)

Clinical Situation: Beta blockers in STEMI patients not in heart failure and with a Left ventricular ejection fraction >40%

Guidance:

- Routine oral treatment with beta-blockers should be considered during hospital stay and continued thereafter in all patients without contraindications.(10)

Clinical Situation: ACE inhibitors in STEMI patients not in heart failure and with a Left ventricular ejection fraction >40%

Guidance:

- ACE inhibitors should be considered in all patients in the absence of contraindications.(10)

Clinical Situation: Lipid lowering therapy during hospitalization and after discharge for STEMI patients

Guidance:

- It is recommended to obtain a lipid profile in all STEMI patients as soon as possible after presentation. (15)
- It is recommended to start high-dose statin therapy as early as possible regardless of initial LDC-C level, unless contraindicated.(15)

- An LDL-C goal of < 1.8 mmol/L (70 mg/dL) or a reduction of at least 50% if the baseline LDL-C is between 1.8–3.5 mmol/L (70–135 mg/dL) is recommended. (10)
- In patients with LDL-C ≥ 1.8 mmol/L (70 mg/dL) despite a maximally tolerated statin dose who remain at high risk, further therapy to reduce LDL-C should be considered. (10)
- Lipid levels should be re-evaluated 4-6 weeks after the event to determine whether the target LDC-C was attained.(15)

Clinical Situation: Cardiac rehabilitation and structured secondary prevention in patients post STEMI

Guidance:

- It is recommended that secondary prevention measures, including medical therapy and lifestyle changes, are started and reinforced after myocardial revascularization.(14)
- It is recommended to identify smokers and provide repeated advice on stopping, with offers to help with the use of follow-up support, nicotine replacement therapies, varenicline, and bupropion individually or in combination.(10)
- Attendance at cardiac rehabilitation or undertaking a structured secondary prevention service is recommended for all patients hospitalized with ACS.(13)
- It is recommended that patients be re-evaluated after myocardial revascularization (e.g. 3 months at the latest and thereafter, at least on an annual basis) in order to reassess symptoms and adherence to secondary prevention measures and reinforce medical therapy and lifestyle changes when appropriate.(14)

Non-ST Elevation Acute Coronary Syndrome (NSTE-ACS)

NSTE-ACS is part of the acute coronary syndrome spectrum, usually caused by a partial or near-complete occlusion of a coronary artery resulting in compromised blood flow to the myocardium with subsequent myocardial injury.

Patients typically present with chest pressure/ discomfort lasting at least several minutes, at times accompanied by sweating, dyspnea, nausea, and/ or anxiety. If typical chest pain is not associated with a typical rise and fall of cardiac biomarkers the patient is labelled as having unstable angina (UA). On the other hand, if a patient has these symptoms in association with a typical rise and fall of cardiac biomarkers a patient is said to have Non-ST elevation myocardial infarction (NSTE-ACS).

Early risk stratification and treatment is needed. Higher-risk patients should be considered for an early invasive strategy (coronary angiography and revascularization in 12-24 hrs.

Emergency Department (ED)

Assessment and risk stratification

Clinical Situation: The preferred risk score for patients with established ACS

Guidance:

- In NSTE-ACS, quantitative assessment of ischemic risk by means of scores is superior to the clinical assessment alone. The GRACE risk score provides the most accurate stratification of risk both on admission and at discharge.(10)

The GRACE Score (16)

GRACE Risk Score (points 2–306)	
Ischaemic risk	
Age	0–91
Heart rate	0–46
Systolic BP	0–63
Creatinine	2–31
Cardiac arrest at admission	43
ST segment deviation	30
Elevated cardiac markers	15
Killip class	0–64

Score interpretation
% risk by 6 months for all-cause mortality • 60–100 = ~3% risk • 100–140 = ~8.0% risk • 140–180 = ~20% risk • >180 = >40% risk Derived from international registry of ACS patients

Treatment

Invasive versus a non-invasive strategy:

Clinical Situation: NSTE-ACS patients requiring an immediate invasive strategy

Guidance:

- Among patients with NSTE-ACS with very high-risk criteria (on-going ischemia, hemodynamic compromise, arrhythmias, mechanical complications of MI, acute heart failure, recurrent dynamic or widespread ST-segment and/or T-wave changes on ECG), an immediate invasive strategy is recommended (within 2 hours of admission). (13)

Clinical Situation: NSTE-ACS patients requiring an early invasive strategy

Guidance:

- In the absence of very high-risk criteria, for patients with NSTE-ACS with high-risk criteria (GRACE score >140, dynamic ST-segment and/or T-wave changes on ECG or rise and/or fall in troponin compatible with MI) an early invasive strategy is recommended (within 24 hours of admission) (13)

Clinical Situation: NSTE-ACS patients requiring a delayed invasive strategy

Guidance:

- In the absence of high-risk criteria, for patients with NSTE-ACS with intermediate-risk criteria (such as recurrent symptoms or substantial inducible ischemia on provocative testing), an invasive strategy is recommended (within 72 hours of admission).(13)

Clinical Situation: The preferred arterial access in patients with NSTE-ACS

Guidance:

- In centers experienced with radial access, a radial approach is recommended for coronary angiography and PCI.(17)

Clinical Situation: The preferred revascularization strategy for patients with NSTE-ACS found to have multi-vessel coronary artery disease

Guidance:

- In patients with multi-vessel Coronary artery disease, it is recommended to base the revascularization strategy (e.g. ad hoc culprit-lesion PCI, multi-vessel PCI, CABG) on the clinical status and comorbidities as well as the disease severity (including distribution, angiographic lesion characteristics, SYNTAX score), according to the local Heart Team protocol.(17)

Clinical Situation: Which patients with NSTE-ACS are suitable for a non-invasive strategy?

Guidance:

- In patients without high/intermediate risk criteria and no recurrent symptoms, non-invasive testing for ischemia (preferably with imaging) is recommended before deciding on an invasive evaluation.(17)

Adjunctive therapy

Clinical Situation: Recommended Antiplatelet therapy in patients with NSTE-ACS

Guidance:

- Aspirin is recommended for all patients without contraindications at an initial oral loading dose of 150–300 mg (in aspirin-naive patients) and a maintenance dose of 81–162mg/ day long-term regardless of treatment strategy.(17)
- Ticagrelor, or Clopidogrel if Ticagrelor is not available, is recommended before or at latest at the time of PCI and should be maintained over 12 months irrespective of revascularization strategy and stent type, unless there are contraindications such as excessive risk of bleeding.(17)

Clinical Situation: Antiplatelet therapy in the setting of coronary artery bypass surgery

Guidance:

- Its recommended to continue low-dose aspirin until CABG.(10)
- In stabilized Patients requiring CABG who are on DAPT, discontinuation of Ticagrelor and Clopidogrel 5 days before surgery should be considered.(10)

Clinical Situation: The preferred anticoagulants agents in patients with NSTE-ACS

Guidance:

- Fondaparinux (2.5 mg s.c. daily) is recommended as having the most favorable efficacy–safety profile regardless of the management strategy.(17)
- Enoxaparin (1 mg/kg s.c. twice daily) or UFH are recommended when fondaparinux is not available. (17)
- In patients on Fondaparinux (2.5 mg s.c. daily) undergoing PCI, a single i.v. bolus of UFH (70–85 IU/kg, or 50–60 IU/kg in the case of concomitant use of GPIIb/IIIa inhibitors) is recommended during the procedure.(17)
- Enoxaparin should be considered as the anticoagulant for PCI in patients pre-treated with s.c. enoxaparin.(17)
- Crossover between UFH and LMWH is not recommended.(17)

Clinical Situation: The role of Beta-blockers in NSTE-ACS patients

Guidance:

- Oral treatment with beta-blockers is indicated in patients with heart failure and or who have a LVEF <40% unless contraindicated.(17)
- Routine oral treatment with beta-blockers should be considered during hospital stay and continued thereafter in all patients without contraindications.(10)
- Early initiation of beta-blockers treatment is recommended in patients with on-going ischemic symptoms and without contraindications.(17)
- Intravenous beta-blockers must be avoided in patients with hypotension, acute heart failure or AV block, or severe bradycardia. (10)

Clinical Situation: Lipid lowering therapy during hospitalization and after discharge for NSTE-ACS patients?

Guidance:

- It is recommended to obtain a lipid profile in all NSTE-ACS patients as soon as possible after presentation. (15)
- It is recommended to start high-dose statin therapy as early as possible regardless of initial LDC-C level, unless contraindicated.(15)
- An LDL-C goal of < 1.8 mmol/L (70 mg/dL) or a reduction of at least 50% if the baseline LDL-C is between 1.8–3.5 mmol/L (70–135 mg/dL) is recommended. (10)
- In patients with LDL-C ≥ 1.8 mmol/L (70 mg/dL) despite a maximally tolerated statin dose who remain at high risk, further therapy to reduce LDL-C should be considered. (10)
- Lipid levels should be re-evaluated 4-6 weeks after the event to determine whether the target LDC-C was attained.(15)

Hospital management/ pre-discharge planning

Clinical Situation: Monitoring patients with NSTE-ACS

Guidance:

- It is recommended to admit NSTE-ACS patients to a monitored unit.(17)
- Continuous rhythm monitoring for at least 24 h is recommended until the diagnosis of NSTE-ACS is established or ruled out and for those patients at intermediate to high-risk cardiac arrhythmias*.(17)
- Rhythm monitoring up to 24 h or PCI (whichever comes first) should be considered in NSTE-ACS patients at low risk for cardiac arrhythmias**.(17)
- In the absence of signs or symptoms of on-going ischemia, rhythm monitoring in unstable angina may be considered in selected patients (e.g. suspicion of coronary spasm or associated symptoms suggestive of arrhythmic events).(17)

* If one or more of the following criteria is present: Hemodynamically unstable, major arrhythmias, left ventricular ejection fraction less than 40%, failed reperfusion, additional critical coronary stenosis of major vessels or complications related to percutaneous revascularization.

** If none of the above criteria is present.

Clinical Situation: The recommendations for imaging in patients during the hospital stay

Guidance:

- Routine echocardiography to assess resting left or right ventricular function, detect early post-MI mechanical complications, and exclude LV thrombus is recommended in all patients.(10)
- Emergency echocardiography is indicated in hemodynamically unstable patients.(10)

Clinical Situation: The proper timing for repeating echocardiography imaging in patients with left ventricular systolic dysfunction

Guidance:

- In patients with pre-discharge LVEF ≤ 40%, repeat echocardiography 6–12 weeks after MI, and after complete revascularization and optimal medical therapy, is recommended to assess the potential need for primary prevention ICD implantation.(10)

Clinical Situation: Management of diabetic patients or with those with hyperglycemia
Guidance:

- It is recommended to measure glycemic status at initial evaluation in all patients and perform frequent monitoring in patients with known diabetes or hyperglycemia (defined as glucose levels ≥11.1mmol/L or ≥ 200mg/dL).(10)

Clinical Situation: Cardiac rehabilitation and secondary prevention
Guidance:

- It is recommended that secondary prevention measures, including medical therapy and lifestyle changes, are started and reinforced after myocardial revascularization.(14)
- It is recommended to identify smokers and provide repeated advice on stopping, with offers to help with the use of follow-up support, nicotine replacement therapies, varenicline, and bupropion individually or in combination.(10)
- Attendance at cardiac rehabilitation or undertaking a structured secondary prevention service is recommended for all patients hospitalized with NSTE-ACS.(13)
- It is recommended that patients be re-evaluated after myocardial revascularization (e.g. at 3 months and thereafter, at least on an annual basis) in order to reassess symptoms and adherence to secondary prevention measures and reinforce medical therapy and lifestyle changes when appropriate.(14)

Clinical Situation: Management of NSTE-ACS patients with stable or hemodynamically irrelevant ventricular arrhythmias
Guidance:

- Prophylactic treatment with antiarrhythmic drugs is not indicated any may be harmful.(10)
- Asymptomatic and hemodynamically irrelevant ventricular arrhythmias should not be treated with antiarrhythmic drugs.(10)

Clinical Situation: The long-term management of ventricular arrhythmias and risk evaluation for sudden death
Guidance:

- ICD therapy is recommended to reduce sudden cardiac death in patients with symptomatic heart failure (NYHA class II–III) and LVEF ”35% despite optimal medical therapy for >3 months and 6 weeks after MI, who are expected to survive for at least 1 year with good functional status.(10)

Glossary of terms

Acronym	
ACS	Acute Coronary Syndrome
ACE	Angiotensin-Converting Enzyme
ARB	Angiotensin II Receptor Blockers
AV	Atrioventricular
CABG	Coronary Artery Bypass Graft
CAG	Clinical Advisory Group
CCU	Coronary Care Unit
DAPT	Dual Anti-Platelet Therapy
ED	Emergency Department
e.g.	For example,
EMS	Emergency Medical Services
FMC	First Medical Contact
ICD	Implantable Cardioverter Defibrillator
IRA	Infarct Related Arteries
i.v.	Intravenous (injection)
KSA	The Kingdome of Saudi Arabia
LDL-C	Low-density Lipoprotein Cholesterol
LV	Left Ventricular
LVEF	Left Ventricular Ejection Fraction
MACE	Major Adverse Cardiac Event
MI	Myocardial Infarction
MRAs	Mineralocorticoid Receptor Antagonists
NSTE-ACS	Non-ST elevation acute coronary syndrome
P2Y12	P2Y12 is the receptor involved in ADP-stimulated activation of the glycoprotein IIb/IIIa receptor
PPCI/PCI	Primary Percutaneous Coronary Intervention
RV	Right Ventricular
SaO2	Oxygen Saturation level
s.c.	Subcutaneous (injection)
STEMI	ST elevated myocardial infarction (or ST elevated ACS)
UFH	Unfractionated Heparin (anticoagulant drug)

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