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ORIGINAL RESEARCH

Evidence-based clinical standard for the diagnosis and treatment of acute myocardial infarction in adults

Estándar clínico basado en la evidencia para el diagnóstico y tratamiento de adultos con infarto agudo de miocardio

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Abstract

Introduction: Cardiovascular diseases (CVD) are the leading cause of death worldwide. Approximately 85% of CVD deaths were caused by acute myocardial infarctions (AMI) and strokes, with around 80% of those deaths occurring in low- and middle-income countries. Among CVDs, AMI has a serious impact in terms of morbidity and mortality; however, most AMI cases are associated with modifiable risk factors and are, therefore, potentially preventable.
Objective: To identify the indications for the diagnosis and treatment of patients with AMI by developing an Evidence-Based Clinical Standard (EBCS) at a national referral university hospital in Bogotá, Colombia.
Materials and methods: Once the development group was created and the scope and objectives of the EBCS were defined, systematic searches were conducted in March 2021 in MEDLINE, Embase, and LILACS, as well as in development agencies and compilers of clinical practice guidelines (CPGs), to identify CPGs published within the last 5 years that met these objectives and scope. The quality of the selected CPGs was evaluated using the AGREE II instrument. A preliminary proposal for the EBCS (clinical algorithm and recommendations) was developed using the selected CPGs, which was then validated by means of an interdisciplinary consensus (modified Delphi methodology).
Results: Seven CPGs were selected. After reaching full agreement in the interdisciplinary consensus, a 7-section clinical algorithm was consolidated: "diagnosis and classification of AMI," "medical treatment of patients with STEMI," "interventional treatment of patients with STEMI with symptoms lasting <12 hours," "interventional treatment of patients with STEMI with symptoms lasting >12 hours," "medical and interventional treatment of patients with NSTEMI," "treatment following percutaneous coronary intervention in patients with acute myocardial infarction," and "monitoring of patients with AMI in the ICU." Furthermore, key aspects were defined for implementing the algorithm and the clinical recommendations, as well as for evaluating and monitoring their implementation, referred to as checkpoints (section 8).
Conclusion: The evidence-based clinical recommendations included in this EBCS contribute to standardizing practices and actions related to the diagnosis and treatment of AMI in adults in Colombia and even the region.

Resumen

Introducción. Las enfermedades cardiovasculares (ECV) son la principal causa de mortalidad en el mundo. Aproximadamente 85% de las muertes por ECV fueron causadas por infartos agudos del miocardio (IAM) y accidentes cerebrovasculares; además, alrededor de 80% de las muertes ocurren en países de bajos y medianos ingresos. Dentro de las ECV, el IAM tiene un serio impacto en términos de morbilidad y mortalidad; sin embargo, la mayoría de los casos de IAM están asociados con factores de riesgo modificables, por lo que son potencialmente prevenibles.
Objetivo. Identificar las indicaciones para el diagnóstico y tratamiento del IAM en adultos mediante el desarrollo de un estándar clínico basado en la evidencia (ECBE) en un hospital universitario de referencia nacional de Bogotá, Colombia.
Materiales y métodos. Una vez conformado el grupo desarrollador y definidos el alcance y los objetivos del ECBE, en marzo de 2021 se realizaron búsquedas sistemáticas en MEDLINE, Embase y LILACS y en organismos desarrolladores y compiladores de guías de práctica clínica (GPC) para identificar GPC publicadas en los últimos 5 años que respondieran a dichos objetivos y alcance. La calidad de las GPC seleccionadas fue evaluada con el instrumento AGREE II. Con base en las GPC seleccionadas se desarrolló una propuesta preliminar de EBCE (algoritmo clínico y recomendaciones) que fue validada mediante un consenso interdisciplinario (metodología Delphi modificada).
Resultados. Se seleccionaron 7 GPC. Luego de lograr un acuerdo total en el consenso interdisciplinario se consolidó un algoritmo clínico de 7 secciones: "diagnóstico y clasificación del IAM", "tratamiento médico del paciente con IAMCEST", "tratamiento intervencionista del paciente con IAMCEST con duración de síntomas <12 horas", "tratamiento intervencionista del paciente con IAMCEST con duración de síntomas >12 horas", "tratamiento médico y tratamiento intervencionista del paciente con IAMSEST", "tratamiento posterior a intervención coronaria percutánea del paciente con infarto agudo de miocardio", "vigilancia del paciente con IAM en la UCI". Además, se definieron aspectos claves para la implementación del algoritmo y las recomendaciones clínicas y para la evaluación y seguimiento de su implementación, denominados como puntos de control (sección 8).
Conclusión. Las recomendaciones clínicas basadas en la evidencia incluidas en este ECBE contribuyen a estandarizar las prácticas y acciones relacionadas con el diagnóstico y tratamiento del IAM en adultos en Colombia e incluso la región.

Introduction

Cardiovascular diseases (CVD) are the leading cause of death and disability worldwide.[1-4] In recent decades, the number of deaths from CVDs has been dramatically increasing, from 12.1 million in 1990 to 18.6 million in 2019.[2] This upward trend in the number of deaths has persisted over recent years, with these diseases accounting for 438 million disability-adjusted life years lost in 2021 and causing 19.42-20.5 million deaths,[2,3,5,6] approximately one-third of all deaths worldwide.[2,6] Coronary artery disease and stroke ranked first and third in the top 10 leading causes of death (13% and 10% of deaths).[7] According to the World Health Organization (WHO), an estimated 19.8 million deaths (32% of all deaths) were caused by CVD in 2022, with 85% of them resulting from heart attacks and strokes.[1] Furthermore, most deaths (around 80%) occur in low- and middle-income countries.[1,2]

In about 75% of cases, CVD is attributable to modifiable behavioral, metabolic, and environmental risk factors, such as physical inactivity, smoking, excessive alcohol consumption, unhealthy diet, obesity, hypertension, diabetes, and air pollution. Consequently, most CVDs can be prevented by addressing these factors.[1,2,4]

Although, as demonstrated by the data, deaths from CVD have increased globally over the past three decades, largely due to population aging and growth, the age-standardized mortality rate has declined by one-third (from 354.5 deaths per 100 000 people in 1990 to 239.9 deaths per 100 000 people in 2019).[2] However, this decline is uneven across regions, with some regions experiencing a slowdown and stagnation in recent years. Mortality rates have fallen much more rapidly in high-income countries than in middle- and low-income countries, which account for more than 80% of CVD deaths treatment of CVD across the globe, as mentioned above. These findings demonstrate that we are still far from achieving equitable distribution in terms of prevention, diagnosis, and treatment of CVD worldwide.[2]

Moreover, according to an analysis of data available in the Global Burden Disease 2021 conducted by Joseph *et al.*,[3] although the age-standardized prevalence and age-standardized incidence of CVD in the Americas were the third lowest and the lowest among the six WHO regions (7.7% and 639 cases per 100 000 people), the number of annual cases of CVD increased from 2.9 million in 1990 to 4.4 million in 2021, a phenomenon probably caused by population aging and growth. Another noteworthy finding in this region is that 1.1 million deaths were attributable to CVD in 2021 (11% of CVD-related deaths) and that the age-standardized mortality rate was the lowest among the six WHO regions (181 per 100 000 people), yet CVDs account for one-third of deaths in the region.[3]

When comparing subregions, Joseph *et al.*[3] report that in North America, the age-standardized prevalence of CVD in 2021 was approximately 8.4%, the age-standardized incidence decreased between 1990 and 2021 (986 cases vs. 670 cases per 100 000 people), but the number of new cases per year increased from 3.4 million in 1990 to 4.3 million in 2021, resulting in an increase in the total number of cases during this period (29 to 48 million), while the age-standardized mortality rate decreased between 1990 and 2021 (260 vs. 139 per 100 000 people), which was reflected in a relatively stable number of annual deaths attributable to CVD (900 000 to 1 million).

As for Latin America and the Caribbean, the age-standardized prevalence in 2021 was 7.0%, with a decrease in age-standardized incidence between 1990 and 2021 (704 vs. 589 cases per 100 000 people). However, because the number of new cases per year nearly doubled between 1990 and 2021 (2 million vs. 4.1 million), the number of CVD

cases in the subregion increased from 20 million to 47 million during that period. Finally, although there was also a decrease in the age-standardized mortality rate between 1990 and 2021 (288 to 157 deaths per 100 000 people), this has been offset by rapid population aging and growth, leading to an increase in the number of people dying from CVD between 1990 (679 000) and 2021 (more than 1 million).[3]

These data show that, although there is currently a higher prevalence and incidence of CVD in North America, both age-standardized mortality and the number of annual deaths from CVD are higher in Latin America and the Caribbean.[7] This is consistent with the global disparity concerning the decline in CVD mortality rates between high-income countries and low- and middle-income countries,[2] since, as reported in the study by Joseph *et al.*,[3] the data for North America refer to the United States, Canada, and Bermuda, all high-income countries, while the data for Latin America and the Caribbean refer to the rest of the countries in the region (low- and middle-income countries). In this regard, it has been suggested that higher mortality rates in these countries may be related to health inequalities, including difficulties in accessing timely health services by population groups with fewer economic resources.[8]

In Colombia, the age-standardized prevalence, age-standardized incidence, and age-standardized mortality rate in 2021 were between 6-7%, 600-800 cases per 100 000 people, and 100-200 cases per 100 000 people, respectively.[3]

Acute myocardial infarction (AMI) is the most serious clinical manifestation of coronary artery disease and occurs due to a decrease in coronary blood flow, which leads to insufficient oxygen supply to the heart and cardiac ischemia, causing permanent damage to the heart.[10] The primary cause is coronary artery obstruction by atherosclerotic plaques (atherosclerosis); in fact, 70% of AMI deaths are attributed to obstructions caused by these plaques.[10] This condition can alter diastolic and systolic function, increasing the risk of arrhythmias, as well as several serious complications, making immediate restoration of blood flow to the heart through reperfusion therapy essential.[10]

AMI is divided into two categories: non-ST-segment elevation AMI (NSTEMI) and ST-segment elevation AMI (STEMI).[9,10] It should be noted that unstable angina resembles STEMI, but normal cardiac markers allow distinguishing between the two;[10] however, given that it is the imminent precursor to AMI, it is also considered an acute coronary syndrome.[9]

AMI is one of the leading causes of death worldwide, especially in developed countries, accounting for more than 1 million deaths per year in the United States.[9,10] According to a recent systematic review and meta-analysis (2023), the global prevalence of AMI is 3.8% in people under 60 years of age (22 studies; 29 826 717 individuals) and 9.5% in people over 60 years of age (20 studies; 5 071 185 patients).[9] Even though there are several non-modifiable risk factors like age, sex, and family history, most AMI cases (>90%) are associated with modifiable risk factors, including dyslipidemia (particularly high LDL cholesterol levels), smoking, and a sedentary lifestyle, among others.[10,11]

Following the discovery of highly sensitive cardiac biomarkers, the concept of AMI was redefined from a clinical and biochemical perspective.[12] Accordingly, AMI is defined as a myocardial injury detected as a result of elevated cardiac troponin I (cTnI) levels (elevated values with at least one value above the 99th percentile upper reference limit [URL]), together with symptoms and/or signs of myocardial ischemia.[13,14] This definition, referred to as the fourth universal definition of AMI, states that while biochemical evidence of myocardial injury is an indispensable requirement for the diagnosis of AMI, myocardial injury itself is a condition that can occur as a result of many cardiac conditions such as myocarditis or systemic diseases such as renal failure or sepsis.[13]

Once AMI has been diagnosed, early treatment involves the simultaneous implementation of several interventions, namely: pain modulation; hemodynamic assessment and support; reperfusion therapy with primary percutaneous coronary intervention (PCI) or fibrinolytic therapy; antithrombotic therapy to prevent rethrombosis or acute stent thrombosis; and beta blocker therapy to prevent recurrent myocardial ischemia and life-threatening ventricular arrhythmias.[14] Several pharmacological therapies have demonstrated long-term benefits in the prognosis of these patients, including the use of angiotensin-converting enzyme (ACE) inhibitors to prevent left ventricular remodeling[15] and the use of statins[16] and anticoagulants[17] to prevent the need for embolization in the presence of left ventricular thrombus or chronic atrial fibrillation.

Comprehensive care for patients with AMI involves health care professionals from various fields, namely internal medicine, cardiology, general surgery, critical care, pharmacy, radiology, and nursing. For this reason, standardizing practices and actions involved in the diagnosis and treatment of these patients is essential to reduce management variability in this clinical setting (hospital wards and intensive care units), optimizing the use of resources and improving the quality of care provided to this population.

In light of the above, the objective of this article is to identify the clinical indications for the diagnosis and treatment of AMI in adults by developing an evidence-based clinical standard (EBCS) at a national referral university hospital in Bogotá, Colombia.

Materials and methods

This EBCS was developed through a sequential seven-phase process proposed by the Hospital Universitario Nacional de Colombia, in collaboration with the Universidad Nacional de Colombia and the Instituto de Investigaciones Clínicas (Clinical Research Institute) of the Universidad Nacional de Colombia. The phases are described below.

Formation of the development group

The development group comprised experts in cardiology, internal medicine, and clinical epidemiology (a methodological leader with experience in the development of clinical standards, one health care professional with training in evidence-based medicine, a third-year internal medicine resident, and a cardiology specialist with experience in the treatment of patients with AMI), who participated in online meetings to establish the methodological, technical, and thematic guidelines for the formulation of the EBCS recommendations. Prior to agreeing to join the development group, all members completed a conflict-of-interest disclosure form.

EBCS scope definition and objectives

The EBCS scope was established based on the following elements: i) target population on which the recommendations will be used; ii) special populations on which the recommendations can be used, such as indigenous peoples, Afro-descendant communities, rural populations, etc., to ensure health equity; iii) aspect of the condition or disease to be addressed (treatment, diagnosis, prevention, follow-up, etc.); iv) aspects of the condition or disease that are beyond the scope of the recommendations; v) health care context (outpatient consultation, inpatient service, surgery service, intensive care, etc.);

and vi) specialties, areas, or health services involved in the implementation and use of the recommendations.

This EBCS is intended to develop a clinical algorithm for the diagnosis and treatment of adult patients with AMI treated at a national referral university hospital in Bogotá, either in the inpatient ward or the intensive care unit (ICU), based on the best available clinical evidence. It should be noted that the EBCS does not contain recommendations for pediatric patients (<18 years) or pregnant women.

The recommendations included in the EBCS are aimed at healthcare workers involved in the care of adult patients with AMI (general practitioners, internal medicine physicians, cardiologists [clinical cardiology, electrophysiology, and interventional cardiology], cardiovascular surgeons, intensive care physicians, nurses, pharmacists, and clinical laboratory specialists). Furthermore, it was established that the recommendations could also be used by health sciences students (undergraduate and graduate) who are involved in the care of these patients during their clinical practice, their professors, and the health care or administrative staff of the health care institutions in charge of making decisions regarding the treatment and follow-up of this population.

The general and specific objectives of this EBCS were defined based on a literature review, an analysis of the care areas involved in the management of these patients, and an interdisciplinary consensus. The formulated objectives clearly and succinctly describe the purpose of the EBCS. Checkpoints and guidelines for the dissemination and implementation of the EBCS were also included in its preparation.

Systematic review of clinical practice guidelines

Systematic searches in MEDLINE, EMBASE and LILACS, as well as in clinical practice guideline (CPG) development and compiling agencies were conducted using controlled language and sensitive electronic search strategies to identify CPGs that met the stated objective and scope (Supplement 1). Searches were conducted on March 3, 2021. The CPG screening and selection process was carried out taking into account the following eligibility criteria established by the development group:

Inclusion criteria

- CPGs on the diagnosis and treatment of AMI in adult patients admitted to hospital or ICU.
- CPGs published in English or Spanish with full-text access.
- CPGs published within the last five years at the time of performing the search.

Exclusion criteria

- CPGs with an overall quality assessment <6 according to the AGREE II instrument[18] or a score <60% in the methodological rigor and editorial independence domains.
- CPGs on the diagnosis and treatment of AMI in pediatric patients and pregnant women.
- CPGs on the diagnosis and treatment of AMI in patients with unstable angina.

Evidence was screened by reviewing titles and abstracts, as well as the full text of the papers identified in the systematic searches. This process was performed independently by two members of the development team: an internal medicine resident and a member

of the methodology team. It was agreed that any discrepancies would be resolved by a third member (clinical leader). The quality of the selected CPGs was assessed using the AGREE II instrument;[18] this process was also carried out independently by two members of the development group: a clinical expert, and a methodological expert.

Preliminary algorithm development

The development group used the selected CPGs to draft a preliminary proposal of the EBCS (clinical algorithm plus checkpoints [key recommendations for implementing the algorithm and clinical recommendations, as well as for evaluating and monitoring their implementation]). To extract the evidence contained in the seven selected CPGs, an information extraction table was created using a domain system. After reviewing the evidence gathered during several meetings, the development group elaborated the proposed clinical algorithm and recommendations for the diagnosis and treatment of adult patients with AMI. These recommendations included the level of evidence for each of the CPGs used to formulate the recommendation. Importantly, the level of evidence is presented following the evidence grading system used in the CPG.

Developing an interdisciplinary agreement

After identifying the health areas/services involved in the comprehensive care process of adult patients with AMI, representatives of these services at the national reference university hospital where the EBCS was developed were appointed. They received the draft of the clinical algorithm for their assessment prior to attending a consensus meeting. The consensus meeting took place in February 2022 and was attended by representatives of the following hospital care services: internal medicine, cardiology, critical care, nursing, clinical laboratory, pharmacy, and cardiovascular surgery. Clinical leaders were responsible for the presentation of the preliminary algorithm (flowcharts) and the meeting was moderated by a research methodologist.

Seven sections of the EBCS (algorithm), as well as an additional section on checkpoints, were presented at the meeting. Using the modified Delphi methodology and a 9-point Likert scale, it was possible to evaluate the level of agreement among the participants with the information presented in each section. The results of the eight polls confirmed that all participants of the interdisciplinary consensus group fully endorsed the use of the recommendations for the diagnosis and treatment of patients with AMI contained in the flowcharts presented below. More detailed information on this step is available in the full text of this EBCS.[19]

Final algorithm development

Once the interdisciplinary consensus was achieved, the development team met and consolidated the suggestions made at the consensus meeting and based on them, modified the preliminary algorithm of the document.

EBCS review and editing

The final activity of the process involved the revision of the document's wording and layout, resulting in the final version of the EBCS.[19] As in the preliminary proposal, the

recommendations include the level of evidence for each CPG used to formulate the recommendation, and the level of evidence is presented in accordance with the evidence grading system used in each CPG.

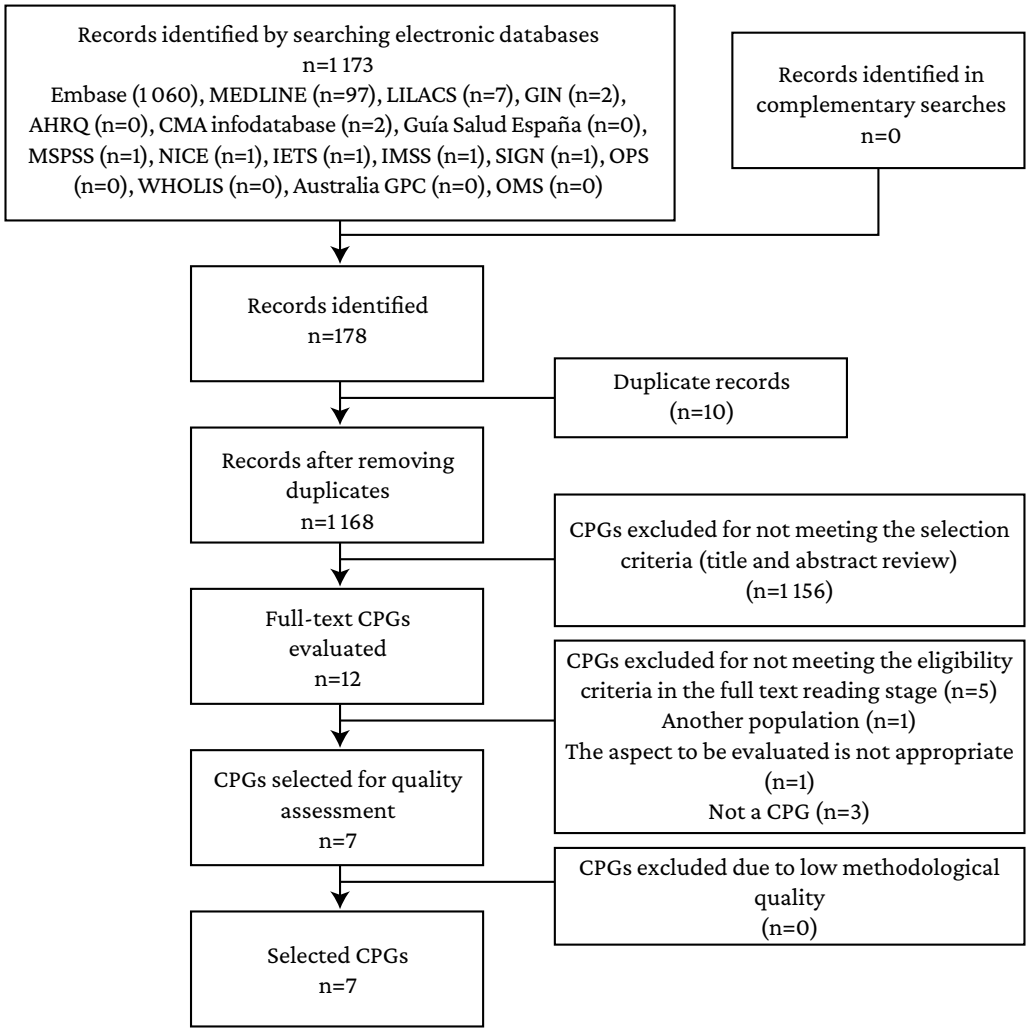
Results

The preliminary searches retrieved 1 173 records. After removing duplicates (n=10), a total of 1 168 were identified, of which 1 156 were excluded at the title and abstract review stage. Then, out of the 12 documents that were fully read, 7 CPGs were selected for quality assessment using the AGREE II instrument.[18] Lastly, during the methodological quality assessment stage, no CPGs were excluded. The 7 CPGs that met the eligibility criteria and were finally included for evidence review are listed in Table 1. The evidence search, screening, and selection process is summarized in Figure 1.

Table 1. Clinical practice guidelines identified in the literature search that met the eligibility criteria for the development of the evidence-based clinical standard.

Id	CPG Title	Development group	Country or continent	Language	Year
CPG1	Acute coronary syndromes.[20]	National Institute for Health and Care Excellence (NICE)	United Kingdom	English	2020
CPG2	Guía de Práctica Clínica para el Síndrome Coronario Agudo.[21]	Instituto de Evaluación Tecnológica en Salud (IETS)	Colombia	Spanish	2017
CPG3	Diagnóstico y Tratamiento del Síndrome Coronario Agudo sin Elevación del Segmento ST. Guía de Evidencias y Recomendaciones: Guía de Práctica Clínica.[22]	Instituto Mexicano del Seguro Social (IMSS)	Mexico	Spanish	2018
CPG4	Acute coronary syndrome. A national clinical guideline.[23]	Scottish Intercollegiate Guidelines Network (SIGN)	Scotland	English	2016
CPG5	2019 Canadian Cardiovascular Society/Canadian Association of Interventional Cardiology Guidelines on the Acute Management of ST-Elevation Myocardial Infarction: Focused Update on Regionalization and Reperfusion.[24]	Cardiovascular Society/ Canadian Association of Interventional Cardiology	Canada	English	2019
CPG6	2020 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation: The Task Force for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation of the European Society of Cardiology (ESC).[25]	European Society of Cardiology (ESC)	European Union	English	2020
CPG7	2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC).[14]	European Society of Cardiology (ESC)	European Union	English	2017

CPG: Clinical practice guideline.



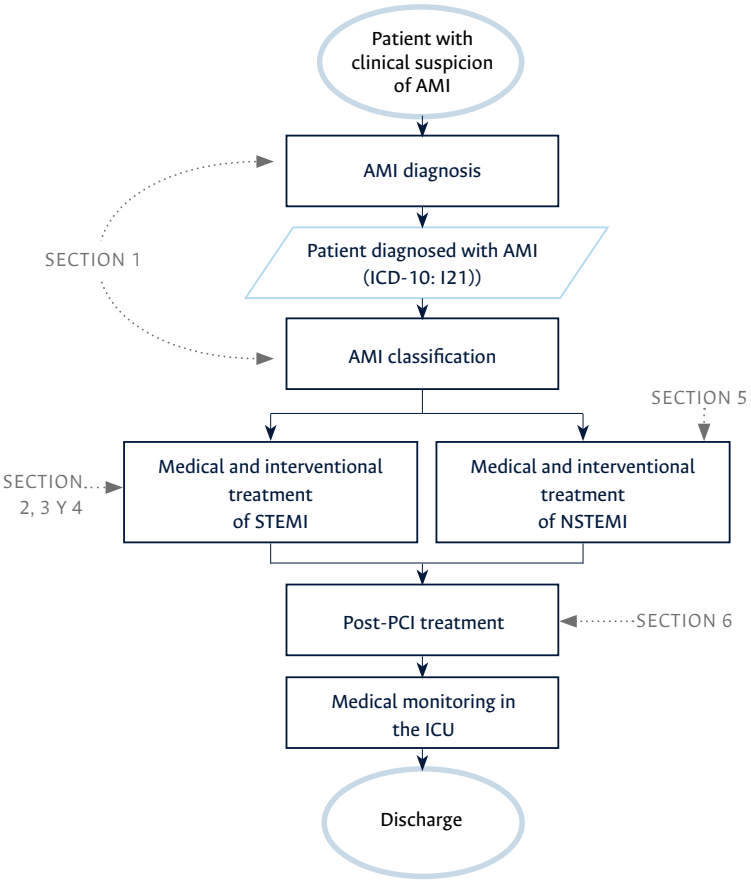
CPG: Clinical practice guideline.
Figure 1. Systematic search for clinical practice guidelines.

Recommendations

The recommendations for diagnosing and treating patients with AMI are presented using the sections of the clinical algorithm formulated by the development group based on the evidence retrieved from the selected CPGs and the opinions of the experts involved in the interdisciplinary consensus (Figure 2). The results are described below:

Section 1 - Recommendations for the diagnostic approach and classification of patients with AMI

Context: AMI is a life-threatening condition, so early identification based on clinical and paraclinical characteristics and timely initiation of treatment are essential to improve the prognosis of these patients. Figure 3 shows the flowchart for Section 1.



AMI: acute myocardial infarctions; ICD-10: International Classification of Diseases, Tenth revisión; STEMI: ST-segment elevation myocardial infarction ST; NSTEMI: non-ST-segment elevation myocardial infarction; PCI: percutaneous coronary intervention; ICU: intensive care unit .
ICD-10: International Classification of Diseases and Related Health Problems, Tenth Revision; CUPS: Unique Code for Healthcare Procedures; ECG: electrocardiogram; AMI: acute myocardial infarction; STEMI: ST-segment elevation myocardial infarction; NSTEMI: non-ST-segment elevation myocardial infarction.

Figure 2. Flowchart for the diagnosis and treatment of adult patients with acute myocardial infarction (ICD-10: I21).

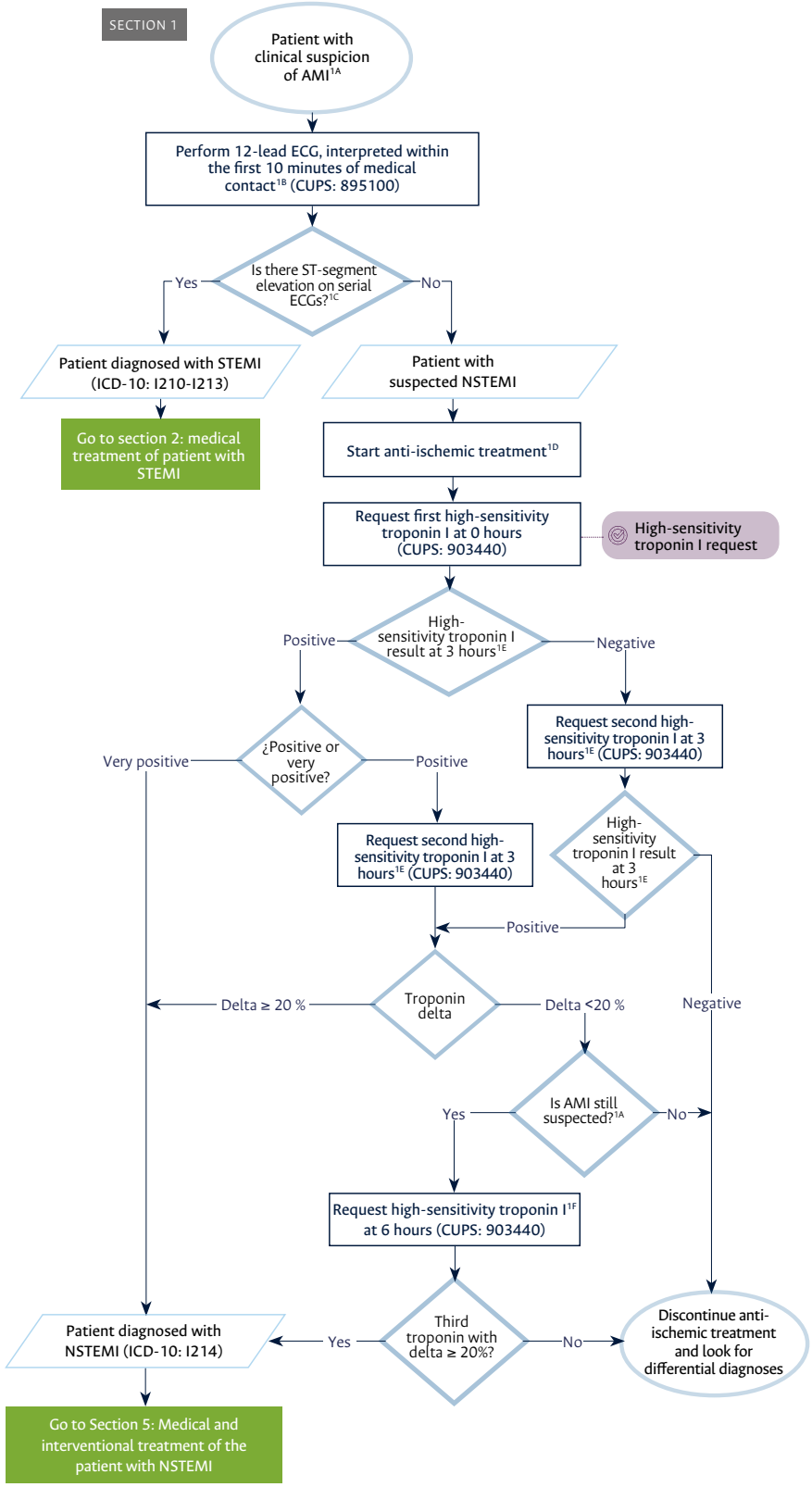


Figure 3. Flowchart for the diagnosis of acute myocardial infarction.

Summary of recommendations:

1.A Clinical symptoms and signs suggestive of AMI: It is considered that a patient has a clinical condition suggestive of AMI when they present with retrosternal pain radiating to the shoulders, jaw, and/or epigastrium, or if they have been admitted to hospital due to cardiopulmonary arrest (expert recommendation).[25] This EBCS must only be used in patients who have experienced symptoms suggestive of AMI for less than 24 hours. If the patient is referred from another institution and troponin levels can be verified (i.e., values and cutoff points are available), clinical management should be initiated according to the algorithm flow and the interpretation of troponin test results. Otherwise, a troponin test must be performed upon admission, depending on symptom progression.

1.B Performing an electrocardiogram on patients with suspected AMI: A 12-lead electrocardiogram (ECG) must be performed within the first 10 minutes of initial medical contact with the patient and interpreted immediately by a physician trained in interpreting this test (level of evidence (LE): B; ESC);[22] (LE: 4; SIGN);[23] (LE: low; GRADE);[24] (LE: B; ESC);[25] (LE: B; ESC).[14]

Additional posterior chest leads (V7-V9) must be considered in patients with high suspicion of posterior AMI (circumflex occlusion) (LE: C; ESC);[22] (LE: low; GRADE);[24] (LE: C; ESC);[25] (LE: C; ESC).[14]

Additional right-sided precordial leads (V3R and V4R) must be considered in patients with inferior wall myocardial infarction (MI) to identify concomitant right ventricular (RV) AMI (LE: C; ESC);[22] (LE: low; GRADE);[24] (LE: C; ESC);[25] (LE: C; ESC).[14]

1.C ST elevation: An ST segment elevation myocardial infarction (STEMI) is diagnosed if ST elevation is ≥2.5mm in men under 40 years of age, ≥2mm in men aged 40 years or older in at least two contiguous leads, or ≥1.5mm in leads V2-V3 or ≥1mm in other leads in women (in the absence of left ventricular hypertrophy or left bundle branch block [LBBB]).

Serial ECGs are recommended at intervals of 15 to 30 minutes when the initial ECG findings do not provide enough information to make a diagnosis and the patient continues to have symptoms, or when there is a high clinical suspicion of AMI (LE: C; AHA);[22] (LE: C; ESC);[25] (LE: C; ESC).[14]

Atypical electrocardiographic findings equivalent to STEMI in patients with symptoms consistent with myocardial ischemia include:

- Branch block: Criteria that can be used to improve the accuracy of STEMI diagnosis in cases of LBBB:
  - Concomitant ST segment elevation ≥1mm in leads with positive QRS complex.
  - Concordant ST segment depression ≥1mm in V1-V3.
  - Discordant ST segment elevation ≥5mm in leads with negative QRS complex.
  - It can be difficult to diagnose STEMI when there is right bundle branch block (RBBB).
- Ventricular rhythm with pacemaker: During RV pacing, ECG also shows LBBB; these criteria are also applicable for diagnosing the patient with AMI during pacing, however, they are less specific.
- Isolated posterior wall acute myocardial infarction: Isolated ST segment depression ≥0.5mm in leads V1-V3 and ST segment elevation (≥0.5mm) in posterior chest wall leads V7-V9.
- Myocardial ischemia caused by occlusion of the left main coronary artery or multivessel coronary artery disease: ST segment depression ≥1 mm in 8 or more surface leads, together with ST segment elevation in aVR or V1, indicates obstruction of the left main coronary artery (or equivalent) or severe 3-vessel disease.

1.D Anti-ischemic treatment: Anti-ischemic treatment with acetylsalicylic acid (ASA), an anticoagulant, and statins can be initiated in patients with clinically suspected AMI before the laboratory report of cTnI levels is available (expert recommendation).

1.E Cardiac troponin I (cTnI) tests (0 and 3 hours): A dynamic elevation of cTnI levels above the 99th percentile in healthy individuals is indicative of AMI. It must be noted that in order to determine a dynamic elevation, cTnI level data from two tests performed within a 3-hour interval are required (expert recommendation).[26]

- A positive ultrasensitive cTnI test is defined as a cTnI value above the 99th percentile URL and up to 5 times the 99th percentile value (expert recommendation).[26]
- A highly positive ultrasensitive cTnI test is defined as a cTnI value >5 times the 99th percentile LSR value (expert recommendation).[26]
- A highly positive ultrasensitive cTnI test is defined as a cTnI value >5 times the 99th percentile LSR value (expert recommendation).[26]

The combined analytical and biological variation of ultrasensitive troponin assays is 50% to 60%. When values are positive, analytical variation is lower, and a 20% index can be used to determine whether cTnI levels are appropriate within a clinical context. For this reason, a ≥20% troponin delta value is used (expert recommendation).[26]

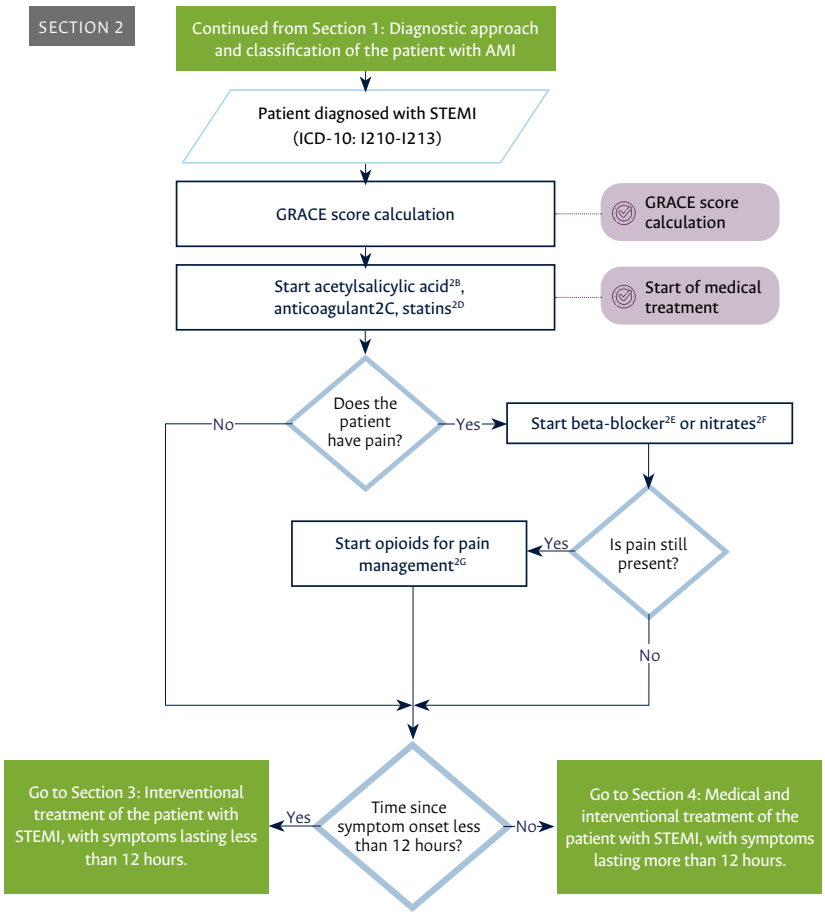
The protocol of performing two cTnI tests within a 3-hour interval (0 and 3 hours) is applicable only to in-hospital AMI patients, not to referred patients.

In this regard, Wildi *et al.*,[27] in a study of 2 727 patients with symptoms and signs suggestive of non-ST-segment elevation myocardial infarction (NSTEMI) treated at the emergency department, which measured the performance of the 0- and 3-hour protocol for ruling out AMI by comparing the use of ultrasensitive cTnI tests with non-ultrasensitive cTnI tests, found that, in four trials of ultrasensitive cTnI, the 0-hour protocol correctly ruled out 99.8% (95% CI: 98.7-100), 99.6% (95% CI: 98.5-99. 9), 100% (95% CI: 97.9-100), and 100% (95% CI: 98.0-100), respectively, of patients with clinically suspected AMI who presented to the emergency department more than 6 hours after the onset of chest pain. In turn, the 3-hour protocol adequately ruled out 99.9% (95% CI: 99.1-100), 99.5% (95% CI: 98.3-99. 9), 100% (95% CI: 98.1-100), and 100% (95% CI: 98.2-100) of patients with clinically suspected AMI who went to the emergency department within 6 hours of the onset of chest pain (expert recommendation).[27]

1.F Third cTnI test (6 hours): A third cTnI test must be requested 6 hours later if the first two cTnI measurements are inconclusive and the patient's clinical condition still suggests AMI (LE: B; ESC).[25] In this regard, Bjurman *et al.*,[28] in a study conducted in Sweden on 1 178 patients, in which changes in cTnI levels were monitored using ultrasensitive cTnI tests, found that mortality in patients with <20% variability in the first two troponin measurements was the same as in those with ≥20% variability or change. This suggests that small changes in troponin levels measured with ultrasensitive tests may not be useful for ruling out a STEMI diagnosis, so a third ultrasensitive cTnI test is recommended if AMI is still clinically suspected (expert recommendation).[28]

Section 2 - Recommendations for the medical treatment of patients with STEMI

Context: The initial approach to patients diagnosed with STEMI must include an assessment of event severity and the timely initiation of pharmacological treatment to improve symptoms and perfusion. Figure 4 presents the flowchart for Section 2.



ICD-10: International Classification of Diseases and Related Health Problems, Tenth Revision; GRACE: Global Registry of Acute Coronary Events; STEMI: ST-segment elevation myocardial infarction.
Figure 4. Flowchart of medical treatment for patients with acute myocardial infarction with ST segment elevation.

Summary of recommendations:

2.A GRACE score: The Global Registry of Acute Coronary Events (GRACE) score predicts the risk of mortality and reinfarction six months after an AMI. This instrument requires the following data to calculate the score: age, heart rate, systolic blood pressure (SBP), serum creatinine levels, ECG, cTnI levels, Killip classification, and clinical condition suggestive of AMI (expert recommendation).[29,30]

- Killip classification: The Killip classification system quantifies the severity of heart failure in patients with AMI and predicts the risk of mortality at 30 days. As mentioned above, this classification is necessary to calculate the GRACE score (expert recommendation).[31,32]

2.B Acetylsalicylic acid (ASA): In AMI patients, this drug must be administered with a loading dose of 300mg orally (chewed), followed by a maintenance dose of 100mg/day (LE: high; GRADE).[21] (LE: A; ESC);[22] (LE: 1++, SIGN);[23] (LE: A; ESC);[24 26] (LE: A; ESC).[14]
ASA must not be used in patients suffering from (expert recommendation):[33]

- Hypersensitivity to ASA or other salicylates or to any component of this drug.
- History of asthma induced by the administration of salicylates or agents with similar action, particularly nonsteroidal anti-inflammatory drugs.
- Acute gastrointestinal ulcers.
- Bleeding diathesis.

- Severe kidney failure.
- Severe liver failure.
- Severe heart failure.
- Patients undergoing treatment with methotrexate at doses of 15mg/week or more.
- Women in the last trimester of pregnancy.

2.C Anticoagulant therapy: Unfractionated heparin (UFH) must be administered as follows if the patient undergoes percutaneous coronary intervention (PCI): intravenous bolus of 70IU/kg to 100IU/kg when anti-GPIIb/IIIa administration is not considered, or intravenous bolus of 50IU/kg to 70IU/kg in combination with anti-GPIIb/ IIIa (LE: A; ESC);[25] (LE: A; ESC).[14] If the patient receives fibrinolytic treatment, intravenous enoxaparin must be administered in a bolus dose of 0.5mg/kg and maintenance doses of 1mg/kg subcutaneously (SC) every 24 hours. In patients undergoing fibrinolytic therapy, the dose is 1.0mg/kg SC every 12 hours (dose adjustment must be considered in patients >75 years of age or with a glomerular filtration rate <30mL/min/m^2 (LE: A; ESC).[14]

Enoxaparin must not be administered to patients with:[34]

- Hypersensitivity to enoxaparin sodium, heparin, or its derivatives, including other low molecular weight heparins, or to the components of the formula.
- History of autoimmune heparin-induced thrombocytopenia within the last 100 days or in the presence of circulating antibodies.
- Active major bleeding and conditions with a high risk of uncontrolled bleeding, including recent hemorrhagic cerebrovascular disease.

2.D High-intensity statins: Atorvastatin must be administered at a dose of 40-80mg orally once a day or rosuvastatin at a dose of 20-40mg orally once a day (LE: high; GRADE);[21] (LE: A; ESC);[22] (LE: 1++, SIGN);[23] (LE: A; ESC);[25] (LE: A; ESC).[14] The dose can be adjusted at 4-week intervals up to a maximum dose of 80mg/day (expert recommendation).[35]

Statins are contraindicated for use in patients with (expert recommendation):[35]

- Hypersensitivity to the components of this type of medication.
- Active liver disease or in patients with persistent elevation of liver enzymes without explanation.
- Patients who are breastfeeding.
- Pregnant women.

2.E Beta blockers: Beta blockers can be used in patients with chest pain to control symptoms. Metoprolol succinate must be administered at an initial dose of 50mg/day and titrated as tolerated. If there are no contraindications, the dose may be increased to a daily dose of 100-200mg. Regarding maintenance treatment after an AMI, long-term oral treatment with metoprolol succinate at a daily dose of 200mg has proven to reduce the risk of death (including sudden death) and the risk of reinfarction (also in patients with type 2 diabetes mellitus) (expert recommendation).[36]

Metoprolol succinate must not be administered to patients with hypotension, acute heart failure (pulmonary edema, hypoperfusion, or hypotension), atrioventricular block, or severe bradycardia (LE: high; GRADE);[21] (LE: A; ESC);[22] (LE: 1++, SIGN);[23] (LE: A; ESC);[24] (LE: IA; ESC),[14] sick sinus syndrome (unless a permanent pacemaker has been implanted), severe peripheral arterial circulation disorders, or known hypersensitivity to any component of the product or to any other beta blocker (expert recommendation).[36]

Metoprolol succinate must be started before discharge, especially in patients with heart failure or left ventricular ejection fraction (LVEF) ≤40%, provided there are no contraindications such as acute heart failure or SBP<120mmHg (LE: high; GRADE);[21] (LE: A; ESC).[14]

2.F Nitrates: Intravenous nitrates may be useful during the acute phase of AMI in patients with hypertension or heart failure, provided there is no hypotension or RV AMI

and no phosphodiesterase type 5 inhibitors have been administered in the last 48 hours (LE: high; ESC);[21] (LE: A; ESC);[22] (LE: A; ESC).[25]

The availability of these drugs in the hospital must be considered prior to prescribing them. If the patient is in the inpatient ward, isosorbide dinitrate must be used; if they are in the ICU, intravenous nitroglycerin can be used at an initial infusion rate of 5-10mcg/min, which can be gradually increased to 5-20mcg/min at 10-minute intervals. The dose must not exceed 400mcg/min (expert recommendation).[37]

Concerning isosorbide dinitrate, the initial sublingual dose must not exceed 5mg, as severe hypotension may occasionally occur. The recommended dose is 5-20mg orally 2 or 3 times a day. Administration must begin with the minimum effective dose and be adjusted as necessary. The use of nitrates is contraindicated in patients undergoing treatment with sildenafil, as extreme hypotension shock may occur when sildenafil is combined with nitrates (expert recommendation).[38]

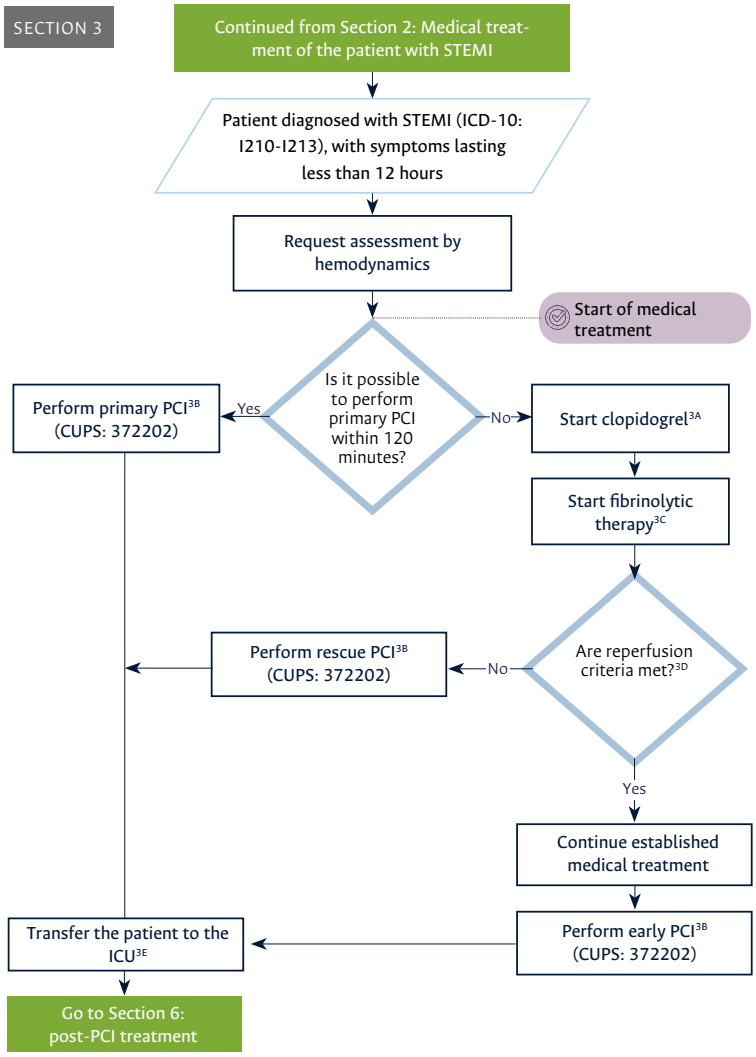
2.G Opioids: Opioids must be considered to relieve pain (LE: A; ESC).[26] Morphine must be administered intramuscularly or subcutaneously at a dose of 5-20mg (starting with a maximum of 10mg) every 4 hours as required, or intravenously at a dose of 4-10mg diluted in 4-5mL of water for injection, administered slowly. If pain is severe, it can be administered by intravenous infusion. This drug must be administered for pain management starting with low doses and gradually increasing until pain is controlled, selecting the minimum dose that achieved pain relief as the maintenance dose. In any case, it is necessary to watch closely for adverse effects such as respiratory depression, which must be treated with naloxone (expert recommendation).[39]

Morphine is contraindicated in patients with (expert recommendation):[39]

- Hypersensitivity.
- Respiratory depression.
- Biliary colic.
- Acute liver disease.
- Use of monoamine oxidase inhibitors up to 2 weeks prior to morphine administration.
- Head trauma.
- Idiopathic intracranial hypertension.
- Status seizures.
- Acute alcohol intoxication or delirium tremens.

Section 3 - Recommendations for interventional treatment in patients with STEMI whose symptoms have lasted less than 12 hours

Context: Patients with STEMI whose symptoms have lasted less than 12 hours must undergo a thorough assessment to identify the medical procedure or pharmacological treatment that will benefit them most. Figure 5 shows the flowchart for Section 3.



ICD-10: International Classification of Diseases and Related Health Problems, Tenth Revision; AMI: acute myocardial infarction; STEMI: ST-segment elevation myocardial infarction; PCI: percutaneous coronary intervention; ICU: intensive care unit.

Figure 5. Flowchart of interventional treatment for patients with ST-segment elevation myocardial infarction whose symptoms have lasted less than 12 hours.

Summary of recommendations:

3.A Clopidogrel: A loading dose of 300-600mg and a maintenance dose of 75mg/day must be administered (LE: high; GRADE);[21] (LE: A; ESC);[22] (LE: 1++, SIGN);[23] (LE: A; ESC);[24] (LE: IA; ESC).[14] Clopidogrel can be administered with or without food, as there is no evidence of significant differences in its absorption or in the bioavailability of its active metabolite. Administration can begin at any time prior to PCI, but it is recommended to do so at least 5 hours beforehand. However, if necessary, treatment can be started within the first few hours after PCI, following the same dosing regimen described above (expert recommendation).[40]

This drug must not be used in patients with (expert recommendation):[40]

- Hypersensitivity to this product or any of its components.
- Active pathological bleeding (e.g., peptic ulcer or intracranial hemorrhage).
- Severe liver impairment.
- Breastfeeding women.

3.B Percutaneous coronary intervention: Before performing PCI, cardiac catheterization must have been performed at least once. When requesting PCI, an assessment by the hemodynamics service must also be requested.

PCI can be performed at different times (expert recommendation):[25]

- Primary PCI: PCI performed within the first 12 hours of symptom onset and within the first 120 minutes of initial medical contact.
- Rescue PCI: PCI performed when fibrinolytic therapy is unsuccessful.
- Early (elective) PCI: PCI performed within the first 24 hours of the patient's admission to the institution.
- Emergency PCI: PCI performed when the patient is hemodynamically unstable.
- Failed PCI: PCI in which reperfusion of the vessel is impossible and the diameter of the stenosis is >30% or has a flow grade ≤2 post-dilatation according to the Thrombolysis in Myocardial Infarction (TIMI) score. If this occurs, the hemodynamics specialist will determine the possibility of performing a surgical procedure and whether the patient needs to be evaluated by the cardiovascular surgery team (expert recommendation).[41]
- Successful PCI: PCI in which vessel patency is achieved with a residual stenosis reduction of <20% (expert recommendation).[42]

3.C Fibrinolytic therapy: When fibrinolytic therapy is the reperfusion strategy, it is recommended to start it as soon as possible after diagnosing STEMI, preferably in the prehospital setting (LE: IA; ESC).[14] Similarly, it is recommended to use a specific fibrin agent, i.e., tenecteplase, alteplase, or reteplase (LE: IA; ESC).[14]

1. Alteplase (tPA): Intravenous bolus of 15mg, followed by a bolus of 0.75mg/kg over 30 minutes (up to 50mg) and then a bolus of 0.5mg/kg over 60 minutes (up to 35mg) (expert recommendation).
2. Tenecteplase (TNK tPA): It is recommended to reduce the dose by half in patients aged 75 years or older. A single intravenous bolus must be administered depending on the patient's weight (expert recommendation):

- weight <60kg, 30mg (6 000UI).
- weight between 60 and <70kg, 35mg (7 000UI); weight between 70 and <80kg, 40mg (8 000UI); weight between 80 and <90kg, 45mg (9 000UI); and weight ≥90kg, 50mg (10 000UI).

Fibrinolytic therapy has the following contraindications (expert recommendation):

- Absolute (if any of the following conditions is present, its use is completely contraindicated):
  - Previous intracranial hemorrhage or stroke of unknown origin at any time.
  - Ischemic stroke in the last 6 months.
  - History of brain or intraspinal tumor, aneurysm, or arteriovenous malformation, or history of neurosurgery (within the last two months) or recent head trauma (within the last month).
  - Trauma/surgery/significant recent head injury (within the last six weeks).
  - Gastrointestinal bleeding (melena) or marked hematuria in the last month.
  - Known bleeding disorder (hemorrhagic diathesis).
  - Pericardial effusion confirmed via focused abdominal ultrasound for abdominal trauma or FAST (focused abdominal sonography for trauma).
  - Aortic dissection.
  - Previous allergic reaction to fibrinolytic drugs.
  - Non-compressible punctures in the last 24 hours (e.g., liver biopsy, lumbar puncture).
  - Traumatic or prolonged cardiopulmonary resuscitation maneuvers (>10 minutes).
- Relative (assessing the risk/benefit of treatment):
  - Less than 10 minutes of cardiopulmonary resuscitation or witnessed cardiac arrest.
  - Cardiogenic shock.

- Transient ischemic attack in the last six months.
- Oral anticoagulant treatment (must be considered an absolute contraindication if the international normalized ratio [INR] is >1.7).
- Retinal hemorrhage.
- Intramuscular injection in the last seven days.
- Occult blood in stool.
- Pregnancy or first postpartum week.
- Refractory hypertension (SBP>180mmHg or diastolic blood pressure [DBP] >120mmHg) that cannot be controlled with treatment.
- Advanced liver or kidney disease.
- Pregnancy, up to one week after delivery.
- Infectious endocarditis.
- Active peptic ulcer.
- Prolonged or traumatic resuscitation.

3.D Reperfusion criteria: Fibrinolytic treatment is considered successful when ST-segment elevation >50% resolves within 60-90 minutes and chest pain disappears (expert recommendation). Arrhythmias due to reperfusion following revascularization procedures do not always indicate vessel patency and reperfusion. Vascular occlusion of the coronary arteries and coronary ischemia can cause multiple arrhythmias, which may not be distinguishable from reperfusion arrhythmias (expert recommendation).[43]

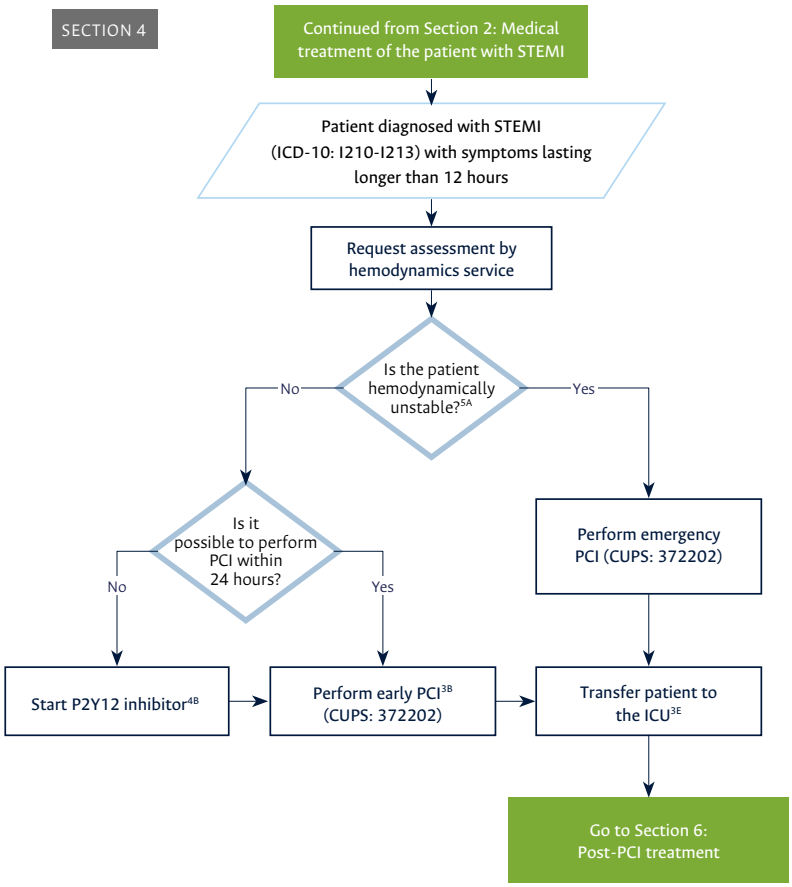
3.E Monitoring: These patients must be monitored in the intensive care unit (ICU) for 24 hours after PCI or at symptom onset. Early transfer to the ICU, i.e., before PCI, must be considered if the patient's clinical condition warrants it, as well as longer monitoring in patients with moderate-to-high risk of cardiac arrhythmias, i.e., patients who meet one or more of the following criteria:

- Hemodynamic instability.
- Significant arrhythmias.
- LVEF<40%.
- Failed reperfusion.
- Critical coronary stenosis in major vessels.
- Complications related to PCI.

After discharge from the ICU, the patient must be monitored for another 24 to 48 hours in the inpatient ward (LE: B; ESC).[14]

Section 4 - Recommendations for the interventional treatment of patients with STEMI whose symptoms have lasted more than 12 hours

Context: The treatment plan for patients with STEMI presenting symptoms lasting >12 hours must be defined taking several factors into account. Figure 6 illustrates the flowchart for Section 4.



ICD-10: International Classification of Diseases and Related Health Problems, Tenth Revision; CUPS: Unique Health Procedures Code; STEMI: ST-segment elevation myocardial infarction; PCI: percutaneous coronary intervention; ICU: intensive care unit.

Figure 6. Flowchart of interventional treatment for patients with ST-segment elevation myocardial infarction whose symptoms have lasted longer than 12 hours.

Summary of recommendations:

4.A Hemodynamically unstable patient: In patients with more than 12 hours since symptom onset, primary PCI is indicated as a reperfusion strategy in the presence of ongoing symptoms suggestive of cardiac ischemia, hemodynamic instability, or life-threatening arrhythmias (LE: B; ESC);[14] namely, patients with persistent chest pain, hypotension (SBP <90mmHg), altered consciousness, dyspnea, tachycardia, bradycardia, post-cardiac arrest syndrome, acute pulmonary edema, and/or cardiogenic shock (expert recommendation).

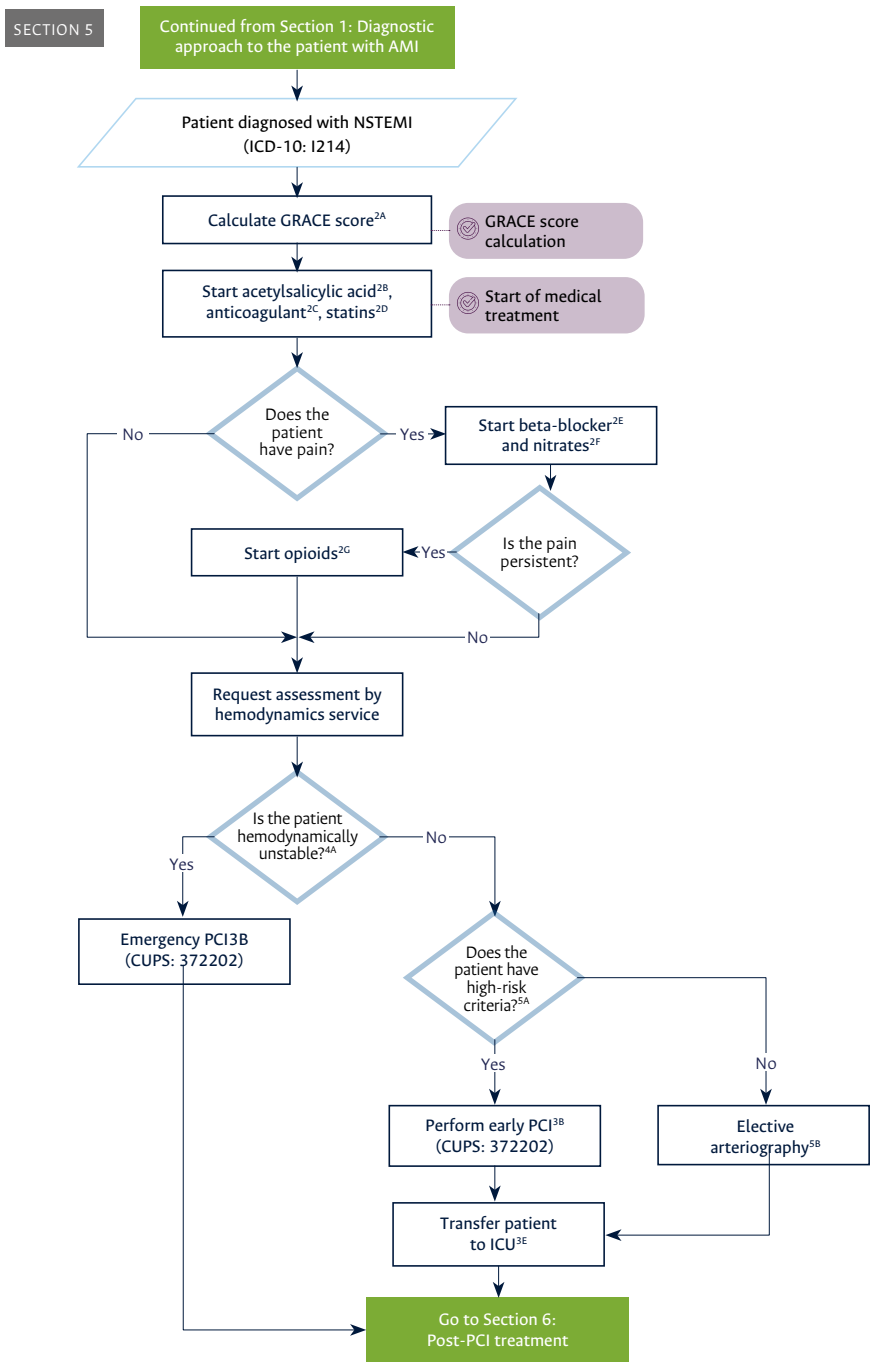
4.B P2Y12 inhibitors: Evidence suggests using the following P2Y12 platelet receptor inhibitors (LE: high; GRADE);[21] (LE: A; ESC);[22] (LE: high, GRADE);[23] (LE: A; ESC);[24] (LE: A; ESC):[14]

- Prasugrel: Loading dose of 60mg orally, followed by a maintenance dose of 10mg/day. For patients weighing ≤60kg, a maintenance dose of 5mg/day is recommended. Its use is contraindicated in patients with a history of stroke or transient ischemic attack. In patients aged 75 years or older or weighing <60kg, a dose of 5mg/day must be used if treatment is considered necessary.
- Ticagrelor: Loading dose of 180mg orally, followed by maintenance doses of 90mg twice daily. Prasugrel and ticagrelor must not be administered to patients with a history of hemorrhagic stroke, undergoing treatment with oral anticoagulants, or with moderate or severe liver disease. The use of ticagrelor may cause transient dyspnea.
- Clopidogrel: This drug must only be used in patients for whom the use of prasugrel or ticagrelor is contraindicated or who will undergo adjuvant treatment before receiving fibrinolytic therapy. Loading dose of 600mg orally, followed by maintenance doses of 75mg/day. It is advisable to

wait 3 to 7 days after suspending these P2Y12 inhibitors to perform revascularization (at least 3 days in the case of ticagrelor, 5 days for clopidogrel, and 7 days for prasugrel).

Section 5 - Recommendations for medical and interventional treatment of patients with NSTEMI

Context: Coronary angiography must be performed taking into account the risk-benefit ratio of this procedure in patients with NSTEMI. Figure 7 shows the flowchart for Section 5.



ICD-10: International Classification of Diseases and Related Health Problems, Tenth Revision; NSTEMI: non-ST-segment elevation myocardial infarction; PCI: percutaneous coronary intervention; ICU: intensive care unit.
Figure 7. Flowchart for the medical and interventional treatment of patients with acute myocardial infarction with non-ST-segment elevation myocardial infarction.

Summary of recommendations:

5.A High-risk criteria: High-risk criteria include (LE: A; ESC):[25]

- NSTEMI diagnosis (does not apply to patients with STEMI).
- New or presumed new dynamic changes in the ST/T segment in subsequent ECGs (symptomatic or silent: asymptomatic).
- GRACE ≥140 points.
- Cardiogenic shock or cardiac arrest.

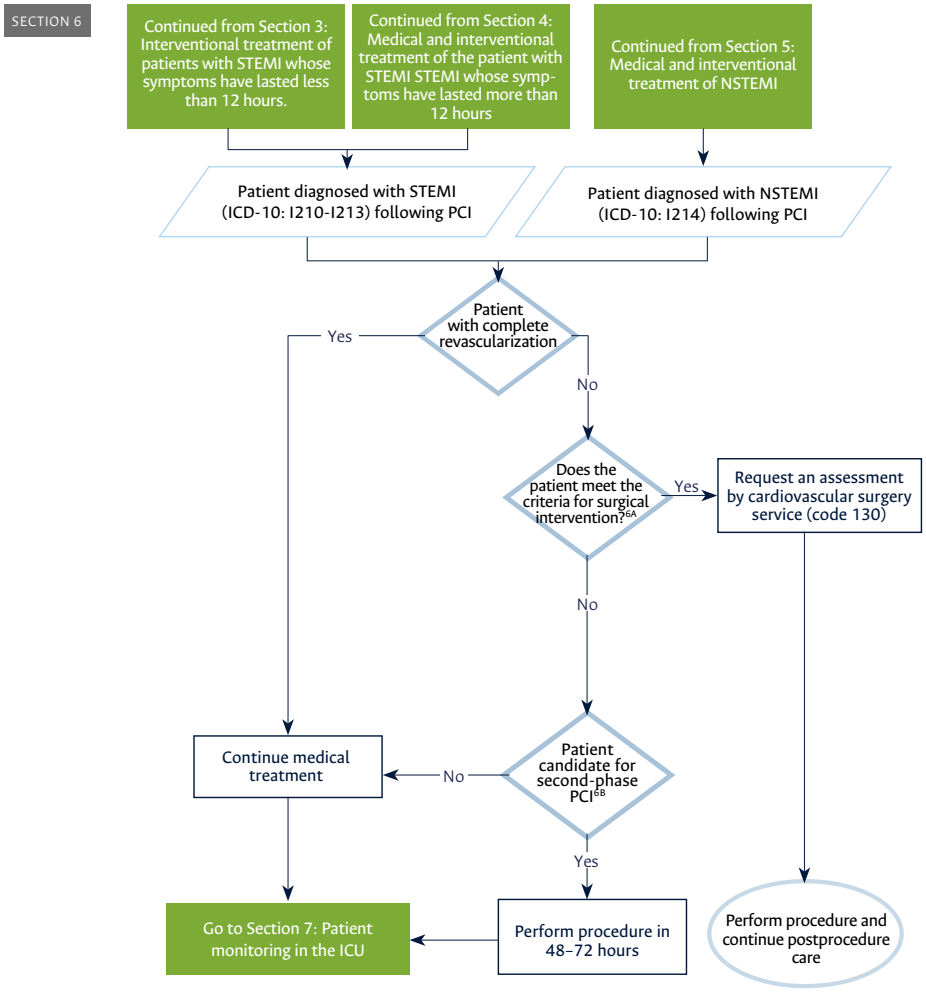
5.B Arteriography: Coronary angiography must be performed on most of these patients, except those who:

1. Refuse catheterization.
2. Show preserved LVEF (≥50%) without structural compromise on transthoracic echocardiogram.

These patients will undergo noninvasive stratification, and outpatient medical treatment may be implemented (expert recommendation).

Section 6 - Recommendations for post-percutaneous coronary intervention treatment of patients with AMI

Context: Percutaneous coronary intervention must be performed taking into account several criteria. Figure 8 provides a flowchart of Section 6.



ICD-10: International Classification of Diseases and Related Health Problems, Tenth Revision; ICU: Intensive care unit; STEMI: ST-segment elevation myocardial infarction; NSTEMI: non-ST-segment elevation myocardial infarction; PCI: percutaneous coronary intervention.

Figure 8. Flowchart for the management of patients with acute myocardial infarction following percutaneous coronary intervention.

Summary of recommendations:

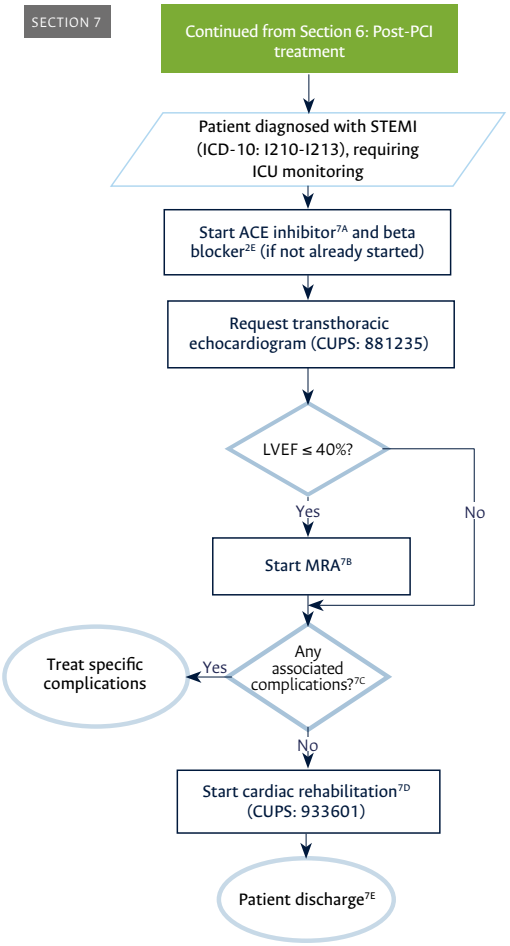
6.A Criteria for surgical intervention: Patients who meet at least one of the following criteria must undergo surgery (expert recommendation):

- Triple vessel coronary artery disease.
- Left main coronary artery disease (equivalent).
- Incomplete revascularization for any reason.

6.B Patient candidate for second percutaneous coronary intervention: A patient will be considered a candidate for a second PCI procedure when this is indicated during the first PCI procedure or when the cardiovascular surgeon decides so after evaluating the patient.

Section 7 - Recommendations for monitoring patients with AMI in the ICU

Context: Care for patients following an AMI and the interventions performed to manage it is essential to reduce the risk of morbidity and mortality. Therefore, cardiac rehabilitation must be started as soon as possible. Figure 9 shows the flowchart for Section 7.



MRA: mineralocorticoid receptor antagonist; ICD-10: International Classification of Diseases and Related Health Problems, Tenth Revision; CUPS: Unique Health Procedures Code; LVEF: left ventricular ejection fraction; NSTEMI: non-ST-segment elevation myocardial infarction; PCI: percutaneous coronary intervention; ACE inhibitor: angiotensin-converting enzyme inhibitor.

Figure 9. Flowchart for monitoring patients with acute myocardial infarction in the intensive care unit.

Summary of recommendations:

7.A Angiotensin-converting enzyme (ACE) inhibitors: ACE inhibitors must be administered within the first 24 hours after an AMI, especially in patients with left ventricular dysfunction, heart failure, type 2 diabetes mellitus, or a history of AMI. It is suggested to start treatment with enalapril at a dose of 5 or 10mg once daily until a maintenance dose of up to 40mg/day is reached. In patients receiving a diuretic, enalapril administration may be started at a dose of 2.5mg/day (expert recommendation).[44]

The use of ACE inhibitors is contraindicated in the following cases (expert recommendation):[44]

- Bilateral renal artery stenosis.
- Renal artery stenosis in a single kidney.
- Severe kidney failure.
- Systemic arterial hypotension.

Similarly, when prescribing ACE inhibitors in combination with potassium-sparing diuretics, caution is required due to the risk of hyperkalemia. Furthermore, the use of these agents in patients with very high renin levels may cause a significant hypotensive response with oliguria or azotemia. Finally, these inhibitors must be administered with caution in patients with liver or kidney damage.

If there are contraindications to the use of ACE inhibitors, an angiotensin receptor blocker (ARB) may be administered, preferably valsartan (LE: high; GRADE);[21] (LE: A; ESC);[22] (LE: 1++, SIGN);[23] (LE: A; ESC);[25] (LE: A; ESC).[14]

7.B Mineralocorticoid receptor antagonists (MRA): MRAs are recommended in patients with LVEF ≤40% and heart failure or type 2 diabetes mellitus treated with an ACE inhibitor and a beta-blocker, provided they do not present with kidney failure or hyperkalemia (LE: high; GRADE);[21] (LE: A; ESC);[22] (LE: 1++, SIGN);[23] (LE: A; ESC);[25] (LE: A; ESC).[14]

7.C Complications associated with acute myocardial infarction: The possible complications associated with an AMI are (expert recommendation):[14,25]

- Potentially lethal arrhythmias.
- Mechanical complications such as severe mitral valve regurgitation, chordae tendineae rupture, interventricular septal rupture, and ventricular free wall rupture.
- Pericarditis (Dressler syndrome).
- Acute heart failure.
- Ventricular dysfunction.

7.D Cardiac rehabilitation: Before the patient is discharged (if medical discharge is considered), it is necessary to begin inpatient cardiac rehabilitation. This request must also include the first consultation with a specialist in physical medicine and rehabilitation, including relevant clinical data (expert recommendation).

Cardiac rehabilitation is important for patients who have suffered an AMI, as they benefit from regular supervised aerobic exercise. They must therefore undergo an individualized assessment to establish a specific care and intervention plan tailored to their particular needs, with the aim of improving their quality of life and reducing hospital admissions (expert recommendation).

7.E Patient discharge: The patient may be discharged to a general hospital ward or to their home; this will depend on their clinical progress.

Section 8 - Checkpoints

The checkpoints for the EBCS, which were defined considering key moments in the comprehensive care of patients with AMI and were chosen jointly by the members of the

development team considering the suggestions made at the interdisciplinary consensus meeting, are presented below:

1. Performance of ultrasensitive cTnI testing for screening all patients with suspected NSTEMI.
2. Compliance with medical treatment for all patients with AMI.
3. Coronary angiography for all patients with AMI.
4. All patients with a confirmed STEMI diagnosis must have their GRACE score entered in their medical records.

Implementation and updating

A multi-stage approach is proposed to implement the EBCS and evaluate adherence to these recommendations. First, an interdisciplinary team will be created, comprising members of the development group and representatives of the administrative and clinical areas of the referral university hospital who can support the implementation process; priority will be given to information technology staff. This team will be key to identifying barriers and facilitators of the implementation process.

Subsequently, two approaches will be adopted to address possible EBCS implementation actions. The first will focus on the dissemination of the clinical algorithm and its checkpoints through educational activities, such as face-to-face and pre-recorded educational talks, and dissemination using social networks and institutional billboards. The second approach will focus on developing administrative strategies that utilize information technology and electronic health record software to generate interactive prompts and reminders that are incorporated into educational activities.

Finally, the assessment of adherence to the EBCS will include three components: i) assessment of EBCS knowledge; ii) assessment of adherence using administrative information sources; and iii) evaluation of impact (clinical, financial, and patient-reported) through additional studies in priority areas of the hospital. The implementation process will take place in stages other than those of the development process, thereby allowing the identification of the best implementation solutions for this EBCS.

The EBCS will be updated in accordance with the stipulated institutional processes. To this end, the development group has set a time limit of 3 to 5 years for updating the EBCS, taking into account various critical aspects: i) the volume of evidence currently available, ii) the availability of new evidence that may have an impact on the comprehensive care of patients with AMI, iii) the quality of the evidence available at the time of EBCS development, and iv) the availability of institutional resources for the implementation and updating of the standard.

Conclusions

The evidence-based clinical recommendations included in this EBCS are intended to standardize practices and actions related to the diagnosis and treatment of adult patients with AMI in Colombia, and even the region. In this sense, the algorithm and clinical recommendations presented here aim to optimize the use of resources and improve the quality of care provided to this population and, therefore, their health outcomes. Finally, it is worth noting that this document can also be used as an educational tool in undergraduate and postgraduate studies for health professionals involved in the care of patients with this condition.

Conflicts of interest

None stated by the authors.

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Supplement 1. Search strategy reporting tables

Database: MEDLINE

Search type	Clinical practice guidelines
Database	MEDLINE
Platform	PubMed
Date of search	03/05/2021
Search date range	Last 5 years
Language restrictions	None
Other restrictions	None
Search strategy	(((((adult[MeSH Terms]) OR (adults[Other Term]) AND (y_10[Filter])) AND ((((((((((("myocardial infarction"[MeSH Terms]) OR (Infarctions, Myocardial[Title/Abstract])) OR (Myocardial Infarctions[Title/Abstract])) OR (Cardiovascular Stroke[Title/Abstract])) OR (Cardiovascular Strokes[Title/Abstract])) OR (Stroke, Cardiovascular[Title/Abstract])) OR (Strokes, Cardiovascular[Title/Abstract])) OR (Myocardial Infarct[Title/Abstract])) OR (Infarct, Myocardial[Title/Abstract])) OR (Infarcts, Myocardial[Title/Abstract])) OR (Myocardial Infarcts[Title/Abstract])) OR (Heart Attack[Title/Abstract])) OR (Heart Attacks[Title/Abstract]) AND (y_10[Filter]))) AND ((((((((((((Diagnosis[MeSH Terms]) OR (Diagnoses[Title/Abstract])) OR (Diagnose[Title/Abstract])) OR (Diagnoses[Title/Abstract] AND Examinations[Title/Abstract])) OR (Examinations[Title/Abstract] AND Diagnoses[Title/Abstract])) OR (Postmortem Diagnosis[Title/Abstract])) OR (Diagnoses, Postmortem[Title/Abstract])) OR (Diagnosis, Postmortem[Title/Abstract])) OR (Postmortem Diagnoses[Title/Abstract])) OR (Antemortem Diagnosis[Title/Abstract])) OR (Antemortem Diagnoses[Title/Abstract])) OR (Diagnoses, Antemortem[Title/Abstract])) OR (Diagnosis, Antemortem[Title/Abstract]) AND (y_10[Filter]))) AND ((((((Therapeutics[MeSH Terms]) OR (Therapeutic[Title/Abstract])) OR (Therapy[Title/Abstract])) OR (Therapies[Title/Abstract])) OR (Treatment[Title/Abstract])) OR (Treatments[Title/Abstract]) AND (y_10[Filter]))) AND (((Practice Guideline[MeSH Terms]) OR (Clinical Practice Guideline[Title/Abstract])) OR (Clinical Guidelines[Title/Abstract]) AND (y_10[Filter]))
References obtained	97
References without duplicates	97

Database: Embase

Search type	Clinical practice guidelines
Database	Embase
Platform	Elsevier
Date of search	03/06/2021
Search date range	Last 5 years
Language restrictions	None
Other restrictions	None
Search strategy	#19 #18 AND [embase]/lim NOT ([embase]/lim AND [medline]/lim) #18 #14 NOT #15 AND [2019-2021]/py #17 #14 NOT #15 #16 #14 AND #15 #15 'child'/exp OR child #14 #3 AND #11 AND #12 AND [2017-2021]/py #13 #3 AND #11 AND #12 #12 'heart infarction'/exp OR 'heart infarction' OR 'heart infarction*':ab,ti OR 'cardiovascular stroke*':ab,ti OR 'myocardial infarct*':ab,ti OR 'heart attack*':ab,ti #11 #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 #10 (disease* NEAR/2 management*):ab,ti #9 therap*:ab,ti OR treatment*:ab,ti #8 'disease management'/exp #7 'therapy'/exp #6 examination*:ab,ti #5 diagnos*:ab,ti #4 'diagnosis'/exp #3 #1 OR #2 #2(guideline* NEAR/2 (clinical OR practice)):ab,ti #1 'practice guideline'/exp OR 'practice guideline'
References obtained	1065
References without duplicates	1060

Database: LILACS

Search type	Clinical practice guidelines
Database	LILACS
Platform	VHL Regional Portal
Date of search	05/05/2021
Search date range	Last 5 years
Language restrictions	None
Other restrictions	None
Search strategy	(mh:(infarto de miocardio)) OR (síndrome coronario agudo) AND (adulto) AND ((guia de practica clinica) OR (protocolo))
References obtained	7
References without duplicates	6

Compiler: Guidelines International Network (GIN)

Search type	Clinical practice guidelines
Database	GIN
Platform	GIN
Date of search	03/05/2021
Search date range	Last 5 years
Language restrictions	None
Other restrictions	None
Search strategy	Acute coronary syndrome, myocardial infarct
References obtained	2
References without duplicates	2

Compiler: Agency for Healthcare Research and Quality (AHRQ)

Search type	Clinical practice guidelines
Database	AHRQ
Platform	AHRQ
Date of search	03/05/2021
Search date range	Last 5 years
Language restrictions	None
Other restrictions	None
Search strategy	Acute coronary syndrome, myocardial infarct
References obtained	0
References without duplicates	0

Compiler: CMA infodatabase

Search type	Clinical practice guidelines
Database	CMA infodatabase
Platform	CMA infodatabase
Date of search	03/05/2021
Search date range	Last 5 years
Language restrictions	None
Other restrictions	None
Search strategy	Acute coronary syndrome, myocardial infarct
References obtained	2
References without duplicates	2

Compiler: Guía Salud España

Search type	Clinical practice guidelines
Database	Guía Salud España
Platform	Guía Salud España
Date of search	03/05/2021
Search date range	Last 5 years
Language restrictions	None
Other restrictions	None
Search strategy	Acute coronary syndrome, myocardial infarct
References obtained	0
References without duplicates	0

Developer: Ministerio de Salud y Protección Social (MSPS)

Search type	Clinical practice guidelines
Database	MSPS
Platform	MSPS
Date of search	03/05/2021
Search date range	Last 5 years
Language restrictions	None
Other restrictions	None
Search strategy	Acute coronary syndrome, myocardial infarct
References obtained	1
References without duplicates	1

Developer: National Institute for Health and Clinical Excellence (NICE)

Search type	Clinical practice guidelines
Database	NICE
Platform	NICE
Date of search	03/05/2021
Search date range	Last 5 years
Language restrictions	None
Other restrictions	None
Search strategy	Acute coronary syndrome, myocardial infarct
References obtained	1
References without duplicates	1

Developer: Instituto de Evaluación Tecnológica en Salud (IETS)

Search type	Clinical practice guidelines
Database	IETS
Platform	IETS
Date of search	03/05/2021
Search date range	Last 5 years
Language restrictions	None
Other restrictions	None
Search strategy	Acute coronary syndrome, myocardial infarct
References obtained	1
References without duplicates	1

Developer: Instituto Mexicano del Seguro Social (IMSS)

Search type	Clinical practice guidelines
Database	IMSS
Platform	IMSS
Date of search	03/05/2021
Search date range	Last 5 years
Language restrictions	None
Other restrictions	None
Search strategy	Acute coronary syndrome, myocardial infarct
References obtained	1
References without duplicates	1

Developer: Scottish Intercollegiate Guidelines Network (SIGN)

Search type	Clinical practice guidelines
Database	SIGN
Platform	SIGN
Date of search	03/05/2021
Search date range	Last 5 years
Language restrictions	None
Other restrictions	None
Search strategy	Acute coronary syndrome, myocardial infarct
References obtained	1
References without duplicates	1

Developer: Pan American Health Organization (PAHO)

Search type	Clinical practice guidelines
Database	OPS
Platform	OPS
Date of search	03/05/2021
Search date range	Last 5 years
Language restrictions	None
Other restrictions	None
Search strategy	Acute coronary syndrome, myocardial infarct
References obtained	0
References without duplicates	0

Developer: WHOLIS

Search type	Clinical practice guidelines
Database	WHOLIS
Platform	WHOLIS
Date of search	03/05/2021
Search date range	Last 5 years
Language restrictions	None
Other restrictions	None
Search strategy	Acute coronary syndrome, myocardial infarct
References obtained	0
References without duplicates	0

Developer: Australian Clinical Practice Guidelines (AHRQ)

Search type	Clinical practice guidelines
Database	AHRQ
Platform	AHRQ
Date of search	03/05/2021
Search date range	Last 5 years
Language restrictions	None
Other restrictions	None
Search strategy	Acute coronary syndrome, myocardial infarct
References obtained	0
References without duplicates	0

Developer: Australian Clinical Practice Guidelines (CPG)

Search type	Clinical practice guidelines
Database	Australian Clinical Practice Guidelines
Platform	Australian Clinical Practice Guidelines
Date of search	03/05/2021
Search date range	Last 5 years
Language restrictions	None
Other restrictions	None
Search strategy	Acute coronary syndrome, myocardial infarct
References obtained	0
References without duplicates	0

Developer: World Health Organization (WHO)

Search type	Clinical practice guidelines
Database	WHO
Platform	WHO
Date of search	03/05/2021
Search date range	Last 5 years
Language restrictions	None
Other restrictions	None
Search strategy	Acute coronary syndrome, myocardial infarct
References obtained	0
References without duplicates	0