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Treatment Approaches in Non-ST-Segment Elevation Acute Coronary Syndrome: From Guidelines to Clinical Practice

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Authors' contributions

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ABSTRACT

Non-ST-segment elevation acute coronary syndrome (NSTE-ACS) encompasses a spectrum of clinical presentations ranging from unstable angina to non-ST-segment elevation myocardial infarction (NSTEMI), representing a significant challenge in contemporary cardiology. This paper overviews treatment approaches in NSTE-ACS, synthesizing evidence from guidelines and clinical practice. After discussing the pathophysiology and clinical presentation of NSTE-ACS, we outline key recommendations from major guidelines, emphasizing medical and invasive management strategies. Pharmacological interventions, including antiplatelet and anticoagulation therapies, are explored alongside considerations for analgesia and symptom management. Invasive approaches such as coronary angiography and percutaneous coronary intervention (PCI) are discussed, highlighting timing and selection criteria for optimal outcomes. Risk stratification tools and their implications for prognosis are analyzed, focusing on special populations and challenges in risk assessment.

Furthermore, we address controversies in NSTE-ACS management, including the balance between risks and benefits of interventions, adherence to guidelines, and emerging therapies. Additional sections cover topics such as patient education, shared decision-making, and considerations for health equity and access to care. The review concludes with insights into future directions in NSTE-ACS management, emphasizing the importance of multidisciplinary collaboration, quality improvement initiatives, and a patient-centered approach. This review is a valuable resource for clinicians involved in the care of NSTE-ACS patients, providing evidence-based guidance and addressing key issues in clinical practice.

Keywords: NSTE-ACS; treatment approaches; guidelines; clinical practice; acute coronary syndrome.

1. INTRODUCTION

Non-ST-segment elevation acute coronary syndrome (NSTE-ACS) represents a significant portion of cases encountered in clinical cardiology practice [1]. NSTE-ACS includes a spectrum of ischemic heart diseases, ranging from unstable angina (UA) to non-ST-segment elevation myocardial infarction (NSTEMI), which collectively contribute to substantial morbidity and mortality worldwide [2]. Despite advancements in diagnostic modalities and treatment strategies, NSTE-ACS remains challenging due to its heterogeneity in clinical presentation, variable prognosis, and complex pathophysiology [3]. The pathophysiological basis of NSTE-ACS involves the disruption of coronary artery plaques, leading to partial or intermittent occlusion of the coronary vessel [4]. Plaque rupture or erosion triggers a cascade of events, including platelet activation, thrombus formation, and vasoconstriction, ultimately resulting in myocardial ischemia [5]. The degree and duration of coronary artery obstruction determine the clinical manifestation, ranging from transient ischemia in UA to myocardial necrosis

in NSTEMI [6]. Diagnosis of NSTE-ACS relies on a combination of clinical evaluation, electrocardiography (ECG), cardiac biomarkers, and imaging modalities [7]. Patients typically present with symptoms of chest discomfort, which may radiate to the neck, jaw, or arm, accompanied by dyspnea, diaphoresis, and nausea [8]. ECG changes such as ST-segment depression or T-wave inversion may be present. Still, the absence of ST-segment elevation distinguishes NSTE-ACS from ST-segment elevation myocardial infarction (STEMI) [9]. Cardiac biomarkers, particularly troponins, confirm myocardial injury and differentiate NSTEMI from UA [10]. Clinical guidelines provide evidence-based recommendations for managing NSTE-ACS, aiming to reduce ischemic events, alleviate symptoms, and improve long-term outcomes [11]. The American College of Cardiology/American Heart Association (ACC/AHA) and the European Society of Cardiology (ESC) guidelines offer consensus-based algorithms for risk stratification and treatment selection in NSTE-ACS [12]. Key principles include early initiation of antiplatelet and antithrombotic therapies, invasive coronary angiography with subsequent revascularization if indicated, and aggressive secondary prevention measures [13]. Medical management of NSTE-ACS involves a multifaceted approach to stabilizing coronary plaques, inhibiting thrombus formation, and alleviating ischemic symptoms [14]. Antiplatelet agents such as aspirin and P2Y12 inhibitors (e.g., clopidogrel, ticagrelor, prasugrel) are cornerstone therapies, targeting different pathways of platelet activation and aggregation [15]. Anticoagulants such as unfractionated heparin, low molecular weight heparin, and direct oral anticoagulants (DOACs) are prescribed to prevent further thrombus propagation and embolization [16]. Additionally, adjunctive therapies such as beta-blockers, nitrates, and statins optimize hemodynamic stability, relieve chest pain, and reduce atherosclerotic burden [17]. Invasive strategies are pivotal in managing high-risk NSTE-ACS patients, aiming to promptly identify and treat culprit lesions responsible for ongoing ischemia [18]. Early invasive strategy, defined as coronary angiography within 24 to 72 hours of hospital admission, is recommended for patients with high-risk features such as refractory angina, hemodynamic instability, or dynamic ECG changes [19]. Percutaneous coronary intervention (PCI) is the preferred revascularization modality, offering rapid restoration of coronary blood flow and symptom relief [20]. However, selecting an invasive strategy should be guided by careful risk assessment, considering individual patient characteristics, comorbidities, and preferences [21]. Risk stratification is crucial in guiding treatment decisions and predicting outcomes in NSTE-ACS patients [22]. Several risk scores and biomarkers have been developed to assess the likelihood of adverse events such as death, myocardial infarction, or recurrent ischemia [23]. For instance, the Global Registry of Acute Coronary Events (GRACE) score incorporates clinical variables such as age, heart rate, and renal function to estimate the risk of mortality in NSTE-ACS patients [24]. High-risk patients identified by risk scores may benefit from more aggressive treatment strategies, including early invasive management and intensified pharmacotherapy [25]. Despite advances in NSTE-ACS management, several challenges and controversies persist in clinical practice [26]. Balancing the risks and benefits of invasive procedures remains a subject of debate, particularly in elderly patients or those with significant comorbidities [27]. Adherence to guideline-directed therapies and quality metrics varies widely among healthcare providers and institutions, highlighting the need for continuous quality improvement initiatives [28]. Moreover, emerging therapies such as novel antiplatelet agents, antithrombotic agents, and invasive techniques present opportunities for improving outcomes but pose challenges in cost-effectiveness and safety [29]. Ultimately, NSTE-ACS represents a heterogeneous and clinically challenging condition with significant implications for patient outcomes and healthcare resource utilization [30-35]. A comprehensive understanding of the pathophysiology, diagnosis, and management principles is essential for clinicians caring for NSTE-ACS patients. By integrating evidence-based guidelines with individualized risk assessment and patient preferences, healthcare providers can optimize outcomes and improve the quality of care in NSTE-ACS.

2. CLINICAL PRESENTATION AND DIAGNOSIS

Non-ST-segment elevation acute coronary syndrome (NSTE-ACS) encompasses a spectrum of clinical manifestations ranging from asymptomatic ischemia to severe chest pain and hemodynamic instability, posing diagnostic challenges for clinicians [1]. The clinical presentation of NSTE-ACS is heterogeneous and

influenced by various factors, including the extent and severity of myocardial ischemia, comorbidities, age, sex, and individual pain perception [2]. Prompt recognition and accurate diagnosis of NSTE-ACS are essential for guiding therapeutic interventions and optimizing patient outcomes. The hallmark symptom of NSTE-ACS is chest discomfort or angina pectoris, typically described as a pressing, squeezing, tightness, or heaviness sensation in the chest, often radiating to the left arm, shoulder, neck, jaw, or back [3]. The intensity and duration of chest pain may vary widely among individuals, ranging from mild discomfort to severe, incapacitating pain lasting minutes to hours [4]. Some patients may experience atypical symptoms such as dyspnea, nausea, diaphoresis, fatigue, dizziness, or epigastric discomfort, particularly in the elderly, women, and those with comorbidities [5]. Additionally, asymptomatic ischemia may occur in certain patients, particularly those with diabetes or autonomic neuropathy, making the diagnosis challenging [6]. Clinical assessment of patients presenting with suspected NSTE-ACS involves a thorough history taking, physical examination, and initial evaluation of vital signs, cardiac rhythm, and oxygen saturation [7]. Attention is paid to the onset, duration, frequency, precipitating factors, and relieving factors of chest pain, as well as associated symptoms such as dyspnea, palpitations, diaphoresis, and syncope [8]. Past medical history, including cardiovascular risk factors such as hypertension, dyslipidemia, diabetes, smoking, and family history of premature coronary artery disease, is carefully elicited to stratify the patient's risk and guide further evaluation and management [9]. Diagnostic tests play a pivotal role in confirming the diagnosis of NSTE-ACS, assessing the extent and severity of myocardial ischemia, and guiding therapeutic decision-making [10]. The initial evaluation typically includes a 12-lead electrocardiogram (ECG), cardiac biomarker testing, and risk stratification using validated scoring systems such as the Thrombolysis in Myocardial Infarction (TIMI) risk score or the Global Registry of Acute Coronary Events (GRACE) score [11]. The ECG is a cornerstone in diagnosing NSTE-ACS, although it may be normal or nondiagnostic in up to 50% of cases [12]. Common ECG findings in NSTE-ACS include ST-segment depression, T-wave inversion, transient ST-segment elevation, or nonspecific changes, reflecting the presence of myocardial ischemia, injury, or repolarization abnormalities [13,36]. Cardiac biomarkers such as troponin and creatine kinase-MB (CK-MB) are sensitive and specific indicators of myocardial injury and necrosis, aiding in diagnosing NSTE-ACS and risk stratification [14]. Troponin, in particular, has emerged as the preferred biomarker due to its high myocardial specificity and prolonged elevation following myocardial injury, allowing for the detection of minor myocardial damage and delayed presentations [15]. Elevated troponin levels above the 99th percentile of the upper reference limit, with a rising or falling pattern, are diagnostic of myocardial infarction (MI) and indicate a poor prognosis in NSTE-ACS patients [16]. Creatine kinase-MB (CK-MB) may also be elevated in NSTE-ACS. However, it lacks the sensitivity and specificity of troponin and is primarily used as a confirmatory test in troponin-negative patients [17]. Additional diagnostic tests may be employed to evaluate myocardial ischemia further, assess cardiac function, and identify underlying coronary artery disease in patients with suspected NSTE-ACS [18]. Exercise treadmill testing, stress echocardiography, nuclear myocardial perfusion imaging, and cardiac magnetic resonance imaging (MRI) are modalities used to detect inducible ischemia and assess myocardial viability, particularly in patients with equivocal or inconclusive initial evaluations [19]. Coronary angiography remains the gold standard for visualizing coronary anatomy, identifying culprit lesions, and guiding revascularization strategies in high-risk NSTE-ACS patients [20,37]. Invasive coronary angiography is indicated in patients with ongoing ischemia, hemodynamic instability, high-risk features on noninvasive testing, or recurrent symptoms despite optimal medical therapy [21]. Risk stratification is crucial in guiding therapeutic decision-making and optimizing outcomes in patients with NSTE-ACS [22,38-40]. Clinical prediction scores, such as the TIMI and GRACE scores, integrate clinical, ECG, and laboratory parameters to estimate the risk of adverse cardiovascular events, including death, MI, and recurrent ischemia [23]. High-risk features associated with adverse outcomes in NSTE-ACS include advanced age, hemodynamic instability, heart failure, renal insufficiency, dynamic ECG changes, elevated cardiac biomarkers, and evidence of ischemia on noninvasive testing [24]. Based on clinical evaluation and risk stratification scores, high-risk patients are candidates for early invasive management strategies, including coronary angiography and revascularization, to reduce the risk of recurrent ischemic events and improve survival [25].

3. GUIDELINES OVERVIEW

The American College of Cardiology (ACC) and the American Heart Association (AHA) have jointly developed comprehensive guidelines for the management of patients with non-ST-segment elevation acute coronary syndrome (NSTE-ACS) [3]. Table 1 illustrates the ACC/AHA guidelines for NSTE-ACS; these guidelines serve as essential tools for healthcare providers in diagnosing, risk stratifying, and treating patients with NSTE-ACS, incorporating the latest evidence-based recommendations to improve patient outcomes. The ACC/AHA guidelines emphasize the importance of a prompt and systematic approach to evaluating and managing patients presenting with symptoms suggestive of NSTE-ACS [12]. Clinical assessment begins with a detailed history, physical examination, and initial evaluation of vital signs, cardiac rhythm, and oxygen saturation [5]. Attention is paid to the onset, duration, and characteristics of chest discomfort or angina, as well as associated symptoms such as dyspnea, nausea, diaphoresis, or syncope. Past medical history, including cardiovascular risk factors such as hypertension, dyslipidemia, diabetes, smoking, and family history of premature coronary artery disease, is carefully elicited to stratify the patient's risk and guide further evaluation and management. Diagnostic evaluation includes a 12-lead electrocardiogram (ECG) and cardiac biomarker testing, with risk stratification using validated scoring systems such as the Thrombolysis in Myocardial Infarction (TIMI) risk score or the Global Registry of Acute Coronary Events (GRACE) score [5,41-44]. The ECG is a cornerstone in diagnosing NSTE-ACS, although it may be normal or nondiagnostic in up to 50% of cases. Common ECG findings include ST-segment depression, T-wave inversion, transient ST-segment elevation, or nonspecific changes reflecting the presence of myocardial ischemia, injury, or repolarization abnormalities. Cardiac biomarkers such as troponin and creatine kinase-MB (CK-MB) are sensitive and specific indicators of myocardial injury and necrosis, aiding in diagnosing NSTE-ACS and risk stratification [8]. Risk stratification is crucial in guiding therapeutic decision-making and optimizing outcomes in patients with NSTE-ACS. Clinical prediction scores, such as the TIMI and GRACE scores, integrate clinical, ECG, and laboratory parameters to estimate the risk of adverse cardiovascular events, including death, MI, and recurrent ischemia. High-risk features associated with adverse outcomes in NSTE-ACS include advanced age, hemodynamic instability, heart failure, renal insufficiency, dynamic ECG changes, elevated cardiac biomarkers, and evidence of ischemia on noninvasive testing. Pharmacological therapy forms the cornerstone of treatment for NSTE-ACS, with antiplatelet agents, anticoagulants, beta-blockers, ACE inhibitors or ARBs, and lipid-lowering therapy recommended to reduce the risk of recurrent ischemic events and improve long-term outcomes [7]. Dual antiplatelet therapy (DAPT), consisting of aspirin and a P2Y12 receptor inhibitor, is recommended as first-line therapy for most patients. Ticagrelor and prasugrel are preferred over clopidogrel in patients undergoing PCI or presenting with high-risk features. Anticoagulant therapy with UFH or LMWH is used in addition to antiplatelet therapy to prevent thrombus formation and reduce the risk of recurrent ischemic events. Beta-blockers exert cardioprotective effects by reducing myocardial oxygen demand, suppressing sympathetic activity, stabilizing myocardial membranes, and improving coronary perfusion [9]. ACE inhibitors or ARBs are recommended for secondary prevention in patients with left ventricular dysfunction, heart failure, diabetes, or hypertension. Statins are recommended in all patients with NSTE-ACS to reduce the risk of recurrent ischemic events and improve long-term outcomes. Invasive coronary angiography with possible PCI or CABG is recommended in high-risk patients with NSTE-ACS, including those with ongoing ischemia, hemodynamic instability, or high-risk features on noninvasive testing. Early invasive management strategies aim to identify and treat culprit lesions, restore coronary perfusion, and prevent recurrent ischemic events, thereby improving outcomes and reducing mortality in high-risk patients [1]. The European Society of Cardiology (ESC) guidelines provide comprehensive recommendations for the diagnosis, risk stratification, and management of non-ST-segment elevation acute coronary syndrome (NSTE-ACS), reflecting the latest evidence-based practices and expert consensus in cardiovascular medicine [5].

Table 1. ACC/AHA Guidelines for NSTE-ACS Management

Diagnostic Evaluation	Recommendations
12-lead ECG	- Perform within 10 minutes of arrival
	- Assess for ST-segment depression, T-wave inversion, transient ST-segment elevation, or nonspecific changes
	- Consider serial ECGs if the initial ECG is nondiagnostic
Cardiac Biomarker Testing	- Measure troponin and CK-MB levels
	- Obtain serial measurements to assess for myocardial injury
Risk Stratification	- Calculate TIMI and GRACE scores
	- Consider clinical, ECG, and laboratory parameters to estimate risk
Pharmacological Therapy	**Recommendations**
Antiplatelet Agents	- Initiate DAPT with aspirin and a P2Y12 receptor inhibitor (ticagrelor or prasugrel preferred over clopidogrel)
Anticoagulants	- Use UFH or LMWH in addition to antiplatelet therapy for anticoagulation
Beta-Blockers	- Consider in all patients unless contraindicated
	- Use cautiously in patients with heart failure, bradycardia, or bronchospasm
ACE Inhibitors or ARBs	- Initiate in patients with left ventricular dysfunction, heart failure, diabetes, or hypertension
Lipid-Lowering Therapy	- Start statin therapy in all patients regardless of baseline lipid levels
	- Use high-intensity statin therapy (atorvastatin 80 mg or rosuvastatin 20-40 mg) for maximum efficacy
Invasive Management	**Recommendations**
Coronary Angiography	- Consider in high-risk patients with ongoing ischemia, hemodynamic instability, or high-risk features on noninvasive testing
	- Aim to identify and treat culprit lesions, restore coronary perfusion, and prevent recurrent ischemic events
PCI or CABG	- Perform PCI or CABG as appropriate based on coronary anatomy, patient characteristics, and procedural considerations

Table 1 illustrates the ACC/AHA guidelines for NSTE-ACS and provides evidence-based recommendations for the diagnosis, risk stratification, and management of patients presenting with this challenging clinical syndrome. These guidelines emphasize the importance of a systematic approach to patient evaluation, risk assessment, and therapeutic decision-making to improve patient outcomes and reduce the burden of cardiovascular disease.

4. MEDICAL MANAGEMENT OF NON-ST-SEGMENT ELEVATION ACUTE CORONARY SYNDROME (NSTE-ACS)

Non-ST-segment elevation acute coronary syndrome (NSTE-ACS) presents a significant challenge in clinical practice, requiring prompt and adequate medical management to mitigate the risk of adverse cardiovascular events and improve patient outcomes. Pharmacological interventions play a central role in the medical management of NSTE-ACS, encompassing antiplatelet therapy, anticoagulation therapy, and analgesia and symptom management. Antiplatelet therapy represents a cornerstone of pharmacological treatment for NSTE-ACS, inhibiting platelet activation and aggregation, thereby reducing the risk of thrombus formation and recurrent ischemic events. Aspirin, a cyclooxygenase (COX) inhibitor, is recommended as first-line therapy in all patients with NSTE-ACS, exerting its antiplatelet effects by irreversibly inhibiting the synthesis of thromboxane A2, a potent platelet agonist [1]. Additionally, dual antiplatelet therapy (DAPT), consisting of aspirin and a P2Y12 receptor inhibitor, is recommended to provide synergistic antiplatelet effects and reduce the risk of recurrent ischemic events [2]. P2Y12 receptor inhibitors such as clopidogrel, ticagrelor, and prasugrel block the adenosine diphosphate (ADP) receptor on platelets, inhibiting ADP-induced platelet activation and aggregation [3]. Ticagrelor and prasugrel are preferred over clopidogrel in patients with NSTE-ACS undergoing percutaneous coronary intervention (PCI) or presenting with high-risk features due to their more potent and rapid onset of action [4]. These antiplatelet agents are typically administered as loading doses, followed by maintenance therapy to achieve and sustain optimal platelet inhibition. Anticoagulation

therapy is another essential component of medical management in NSTE-ACS, aiming to prevent thrombus formation and reduce the risk of recurrent ischemic events. Unfractionated heparin (UFH) and low-molecular-weight heparin (LMWH) are commonly used anticoagulants, exerting their antithrombotic effects by enhancing the activity of antithrombin III, thereby inhibiting thrombin and factor Xa [5]. UFH is typically administered as an intravenous bolus followed by a continuous infusion, whereas LMWH is administered subcutaneously and does not require routine monitoring of activated partial thromboplastin time (aPTT) [6]. Fondaparinux, a synthetic factor Xa inhibitor, represents an alternative anticoagulant option in patients with NSTE-ACS, particularly those at low risk of bleeding, as it offers similar efficacy with a lower risk of heparin-induced thrombocytopenia [7]. Direct oral anticoagulants (DOACs) such as rivaroxaban may be considered in selected patients with NSTE-ACS, particularly those with concomitant atrial fibrillation or a history of venous thromboembolism. However, their role in this setting remains to be fully elucidated [8]. Analgesia and symptom management are essential considerations in the medical management of NSTE-ACS, aiming to alleviate chest discomfort or angina and improve patient comfort and quality of life. Nitrates represent a cornerstone of analgesic therapy in NSTE-ACS, exerting their vasodilatory effects by releasing nitric oxide, promoting coronary artery vasodilation, and relieving myocardial ischemia [9]. Sublingual nitroglycerin is commonly used for the acute relief of angina symptoms in patients with NSTE-ACS. However, intravenous nitroglycerin may be considered in patients with ongoing ischemia or heart failure [10]. Morphine sulfate may be administered in combination with nitroglycerin for the management of severe or refractory chest discomfort in patients with NSTE-ACS. However, its routine use is not recommended due to potential adverse effects such as respiratory depression, hypotension, and delayed diagnosis and treatment [11].

5. INVASIVE MANAGEMENT IN NON-ST-SEGMENT ELEVATION ACUTE CORONARY SYNDROME (NSTE-ACS)

Invasive management strategies play a crucial role in the comprehensive management of non-ST-segment elevation acute coronary syndrome (NSTE-ACS), aiming to identify and treat culprit lesions, restore coronary perfusion, and prevent recurrent ischemic events. Key components of invasive management include coronary angiography, percutaneous coronary intervention (PCI) strategies, and careful consideration of timing and selection criteria for invasive procedures. Coronary angiography represents the gold standard diagnostic tool for assessing coronary anatomy and identifying culprit lesions in patients with NSTE-ACS. This invasive procedure involves the insertion of a catheter into the coronary arteries to inject contrast dye, allowing visualization of the coronary arteries and detecting any obstructive lesions or areas of stenosis. Coronary angiography is essential for risk stratification and guiding subsequent therapeutic interventions, such as PCI or coronary artery bypass grafting (CABG), based on the extent and severity of coronary artery disease [1]. Percutaneous coronary intervention (PCI) strategies are integral to managing NSTE-ACS, aiming to restore coronary perfusion and alleviate myocardial ischemia by treating obstructive lesions identified on coronary angiography. PCI encompasses a range of techniques, including balloon angioplasty, stent placement, and adjunctive therapies such as atherectomy or thrombectomy, depending on the lesion's characteristics and the patient's clinical presentation [2]. The selection of PCI strategy is guided by factors such as lesion complexity, vessel size, and the presence of thrombus or calcification to achieve optimal coronary revascularization while minimizing procedural complications [3]. Timing and selection criteria for invasive procedures in NSTE-ACS represent critical considerations in clinical practice, balancing the benefits of early revascularization with the risks of procedural complications and bleeding. Early invasive management strategies aim to identify and treat high-risk patients with NSTE-ACS, including those with ongoing ischemia, hemodynamic instability, or high-risk features, on noninvasive testing, thereby reducing the risk of recurrent ischemic events and improving outcomes [4]. The selection of patients for invasive procedures is guided by clinical judgment, risk stratification tools, and consensus guidelines, focusing on identifying those who derive the most significant benefit from revascularization [5].

6. CONCLUSION

Managing Non-ST-Segment Elevation Acute Coronary Syndrome (NSTE-ACS) requires a multifaceted approach integrating evidence-based guidelines with individualized patient care.

From the initial presentation to long-term follow-up, healthcare providers must navigate treatment decisions based on a thorough understanding of the patient's clinical profile, risk factors, and preferences. By adhering to established guidelines, healthcare teams can optimize outcomes and reduce the risk of recurrent cardiovascular events. However, the translation of guidelines into clinical practice has its challenges. Variability in patient presentation, comorbidities, and resource availability can complicate decision-making and implementation.

Furthermore, emerging research and technological advancements continuously shape the landscape of NSTE-ACS management, necessitating ongoing education and adaptation among healthcare providers. To address these challenges and improve patient care, a concerted effort is required from all stakeholders. Healthcare organizations should prioritize disseminating guidelines, providing resources for continuing education, and fostering interdisciplinary collaboration. Clinicians must stay abreast of the latest evidence and guidelines, engage in shared decision-making with patients, and advocate for access to appropriate resources and interventions. Patients, in turn, should be empowered to actively participate in their care, adhere to prescribed treatments, and advocate for their health needs. By working together, healthcare providers, policymakers, and patients can ensure that the best available evidence is translated into practice, ultimately improving outcomes and quality of life for individuals affected by NSTE-ACS. Through ongoing collaboration, education, and advocacy, we can strive towards a future where all patients receive timely, guideline-directed care, leading to better health and well-being for individuals and communities.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

CONSENT AND ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Basit H, Malik A, Huecker MR. Non–ST-Segment Elevation Myocardial Infarction. [Updated 2023 Jul 10]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024.
   Available:https://www.ncbi.nlm.nih.gov/books/NBK513228/
2. Damman P, de Winter RJ. Acuut coronair syndroom zonder ST-elevatie [Non-ST segment elevation acute coronary syndrome; recent developments in diagnostics and treatment]. Ned Tijdschr Geneeskd. 2017;161:D1497.
   Available:https://pubmed.ncbi.nlm.nih.gov/28854987/
3. Prejean SP, Din M, Reyes E, Hage FG. Guidelines in review: Comparison of the 2014 AHA/ACC guideline for the management of patients with non-ST-elevation acute coronary syndromes and the 2015 ESC guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation. J Nucl Cardiol. 2018 Jun;25(3):769-776.
   DOI: 10.1007/s12350-017-1137-z.
4. Thomas D, Giugliano RP. Management of non-ST-segment elevation acute coronary syndrome: comparison of the updated guidelines from North America and Europe. Crit Pathw Cardiol. 2012 Jun;11(2):62-73.
   DOI: 10.1097/HPC.0b013e3182563a7e.
5. Martínez-Solano J, Alonso-García A, Álvarez-Zaballos S, Martínez-Sellés M. Management strategy of non-ST segment elevation acute coronary syndromes in octogenarians: a call for a personalized approach. Rev Cardiovasc Med. 2021 Dec 22;22(4):1205-1214.
   DOI: 10.31083/j.rcm2204129.
6. Elendu C, Amaechi DC, Elendu TC, Jingwa KA, Okoye OK, Fiemotonghan BE, Chirinos GA, Agada D, John Okah M, Adebayo OD, Dang K, Egbunu E, Alabi OS, Nasre VS, Yadav CP, Badru MD. Relationship between stress and coronary artery disease: A comprehensive review. Medicine (Baltimore). 2024 Feb 2;103(5):e37066.
   DOI: 10.1097/MD.0000000000037066.

7. Bob-Manuel T, Ifedili I, Reed G, Ibebuogu UN, Khouzam RN. Non-ST Elevation Acute Coronary Syndromes: A Comprehensive Review. Curr Probl Cardiol. 2017 Sep;42(9):266-305.
DOI: 10.1016/j.cpcardiol.2017.04.006.

8. Fermann GJ, Raja AS, Peterson ED, Roe MT, Hoekstra JW, Milford-Beland S, Diercks DB, Pollack CV Jr, Peacock WF, Summers R, Ohman EM, Gibler WB. Early treatment for non-ST-segment elevation acute coronary syndrome is associated with appropriate discharge care. Clin Cardiol. 2009 Sep;32(9):519-25.
DOI: 10.1002/clc.20629.

9. Möllmann H, Nef H, Hamm CW. Das akute Koronarsyndrom ohne ST-Hebung [Acute coronary syndromes without ST segment elevation]. Herz. 2009 Feb;34(1):30-8. German.
DOI: 10.1007/s00059-009-3194-9.

10. Toleva O, Westerhout CM, Senaratne MP, Bode C, Lindroos M, Sulimov VA, Montalescot G, Newby LK, Giugliano RP, Van de Werf F, Armstrong PW. Practice patterns and clinical outcomes among non-ST-segment elevation acute coronary syndrome (NSTE-ACS) patients presenting to primary and tertiary hospitals: insights from the EARLY glycoprotein IIb/IIIa inhibition in NSTE-ACS (EARLY-ACS) trial. Catheter Cardiovasc Interv. 2014 Nov 15;84(6):934-42.
DOI: 10.1002/ccd.25590.

11. Roffi M, Patrono C, Collet JP, Mueller C, Valgimigli M, Andreotti F, Bax JJ, Borger MA, Brotons C, Chew DP, Gencer B, Hasenfuss G, Kjeldsen K, Lancellotti P, Landmesser U, Mehilli J, Mukherjee D, Storey RF, Windecker S; ESC Scientific Document Group. 2015 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation: Task Force for the Management of Acute Coronary Syndromes in Patients Presenting without Persistent ST-Segment Elevation of the European Society of Cardiology (ESC). Eur Heart J. 2016 Jan 14;37(3):267-315.
DOI: 10.1093/eurheartj/ehv320.

12. Collet JP, Thiele H, Barbato E, Barthélémy O, Bauersachs J, Bhatt DL, Dendale P, Dorobantu M, Edvardsen T, Folliguet T, Gale CP, Gilard M, Jobs A, Jüni P, Lambrinou E, Lewis BS, Mehilli J, Meliga E, Merkely B, Mueller C, Roffi M, Rutten FH, Sibbing D, Siontis GCM; ESC Scientific Document Group. 2020 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation. Eur Heart J. 2021 Apr 7;42(14):1289-1367.
DOI: 10.1093/eurheartj/ehaa575.

13. Corrigendum to: 2020 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation. Eur Heart J. 2021 May 14;42(19):1908.
DOI: 10.1093/eurheartj/ehaa895.

14. Corrigendum to: 2020 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation. Eur Heart J. 2021 May 14; 42(19):1925.
DOI: 10.1093/eurheartj/ehab088.

15. Hedayati T, Yadav N, Khanagavi J. Non-ST-Segment Acute Coronary Syndromes. Cardiol Clin. 2018 Feb;36(1):37-52.
DOI: 10.1016/j.ccl.2017.08.003.

16. Bhatt DL, Lopes RD, Harrington RA. Diagnosis and Treatment of Acute Coronary Syndromes: A Review. JAMA. 2022 Feb 15;327(7):662-675.
DOI: 10.1001/jama.2022.0358.

17. Housholder-Hughes SD. Non-ST-segment elevation acute coronary syndrome: impact of nursing care on optimal outcomes. AACN Adv Crit Care. 2011 Apr-Jun;22(2):113-24.
DOI: 10.1097/NCI.0b013e31820b24cf.

18. Martinez-Rumayor A, Januzzi JL Jr. Non-ST segment elevation acute coronary syndromes: A comprehensive review. South Med J. 2006 Oct;99(10): 1103-10.
DOI: 10.1097/01.smj.0000215764.22650.29.

19. Basit H, Malik A, Huecker MR. Non–ST-Segment Elevation Myocardial Infarction. 2023 Jul 10. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024.
Available:https://pubmed.ncbi.nlm.nih.gov/30020600/

20. Camaro C, Aarts GWA, Adang EMM, van Hout R, Brok G, Hoare A, Rodwell L, de Pooter F, de Wit W, Cramer GE, van Kimmenade RRJ, Damman P, Ouwendijk E, Rutten M, Zegers E, van Geuns RM, Gomes MER, van Royen N. Rule-out of non-ST-segment elevation acute coronary syndrome by a single, pre-hospital troponin measurement: a randomized trial. Eur Heart J. 2023 May 14;44(19):1705-1714.
DOI: 10.1093/eurheartj/ehad056.

21. Chang H, Min JK, Rao SV, Patel MR, Simonetti OP, Ambrosio G, Raman SV. Non-ST-segment elevation acute coronary syndromes: targeted imaging to refine upstream risk stratification. Circ Cardiovasc Imaging. 2012 Jul;5(4):536-46.
DOI: 10.1161/CIRCIMAGING.111.970699.

22. Rupprecht HJ, Geeren M, Geeren M, Weilemann S, Schuster HP. Akutes Koronarsyndrom ohne ST-Hebung (NSTE-ACS) [Acute coronary syndrome without ST-elevation (NSTE-ACS)]. Herz. 2019 Feb;44(1):10-15. German.
DOI: 10.1007/s00059-018-4776-1.

23. De Ferrari GM, Fox KA, White JA, Giugliano RP, Tricoci P, Reynolds HR, Hochman JS, Gibson CM, Théroux P, Harrington RA, Van de Werf F, White HD, Califf RM, Newby LK. Outcomes among non-ST-segment elevation acute coronary syndromes patients with no angiographically obstructive coronary artery disease: observations from 37,101 patients. Eur Heart J Acute Cardiovasc Care. 2014 Mar;3(1):37-45.
DOI: 10.1177/2048872613489315.

24. van Diepen S, Lin M, Bakal JA, McAlister FA, Kaul P, Katz JN, Fordyce CB, Southern DA, Graham MM, Wilton SB, Newby LK, Granger CB, Ezekowitz JA. Do stable non-ST-segment elevation acute coronary syndromes require admission to coronary care units? Am Heart J. 2016 May;175:184-92.
DOI: 10.1016/j.ahj.2015.11.020.

25. Trost JC, Lange RA. Treatment of acute coronary syndrome: Part 1: Non-ST-segment acute coronary syndrome. Crit Care Med. 2011 Oct;39(10):2346-53.
DOI: 10.1097/CCM.0b013e31821e855f.

26. Lindow T, Pahlm O, Nikus K. A patient with non-ST-segment elevation acute coronary syndrome: Is it possible to predict the culprit coronary artery? J Electrocardiol. 2016 Jul-Aug;49(4):614-9.
DOI: 10.1016/j.jelectrocard.2016.05.001.

27. Man S, Rahmattulla C, Maan AC, van der Putten NH, Dijk WA, van Zwet EW, van der Wall EE, Schalij MJ, Gorgels AP, Swenne CA. Acute coronary syndrome with a totally occluded culprit artery: relation of the ST injury vector with ST-elevation and non-ST elevation ECGs. J Electrocardiol. 2014 Mar-Apr;47(2):183-90.
DOI: 10.1016/j.jelectrocard.2013.11.009.

28. Huang X, Ramdhany SK, Zhang Y, Yuan Z, Mintz GS, Guo N. New ST-segment algorithms to determine culprit artery location in acute inferior myocardial infarction. Am J Emerg Med. 2016 Sep;34(9):1772-8.
DOI: 10.1016/j.ajem.2016.06.005.

29. Rubini Gimenez M, Thiele H, Pöss J. Management des akuten Koronarsyndroms ohne ST-Strecken-Hebung [Management of acute coronary syndrome without ST-segment elevation]. Herz. 2022 Aug;47(4):381-392. German.
DOI: 10.1007/s00059-022-05120-y.

30. Kaliyadan AG, Savage MP, Ruggiero N 2nd, Fischman DL. An update on management of the patient presenting with non-ST-elevation acute coronary syndromes. Hosp Pract (1995). 2016 Aug;44(3):173-8.
DOI: 10.1080/21548331.2016.1179119.

31. Gilutz H, Shindel S, Shoham-Vardi I. Adherence to NSTEMI Guidelines in the Emergency Department: Regression to Reality. Crit Pathw Cardiol. 2019 Mar;18(1):40-46.
DOI: 10.1097/HPC.0000000000000165.

32. Piątek Ł, Wilczek K, Janion-Sadowska A, Gierlotka M, Gąsior M, Sadowski M. Outcomes of a routine invasive strategy in elderly patients with non-ST-segment elevation myocardial infarction from 2005 to 2014: results from the PL-ACS registry. Coron Artery Dis. 2019 Aug;30(5):326-331.
DOI: 10.1097/MCA.0000000000000708.

33. Manfredonia L, Lanza GA, Crudo F, Lamendola P, Graziani F, Villano A, Locorotondo G, Melita V, Mencarelli E, Pennestrì F, Lombardo A, De Vita A, Ravenna SE, Bisignani A, Crea F. Diagnostic role of echocardiography in patients admitted to the emergency room

with suspect no-ST-segment elevation acute myocardial infarction. Eur Rev Med Pharmacol Sci. 2019 Jan;23(2):826-832.
DOI: 10.26355/eurrev_201901_16897.

34. Rupprecht HJ, Geeren M, Geeren M, Weilemann S, Schuster HP. Akutes Koronarsyndrom ohne ST-Hebung (NSTE-ACS) [Acute coronary syndrome without ST-elevation (NSTE-ACS)]. Herz. 2019 Feb;44(1):10-15. German.
DOI: 10.1007/s00059-018-4776-1.

35. Kamińska J, Koper OM, Siedlecka-Czykier E, Matowicka-Karna J, Bychowski J, Kemona H. The utility of inflammation and platelet biomarkers in patients with acute coronary syndromes. Saudi J Biol Sci. 2018 Nov;25(7):1263-1271.
DOI: 10.1016/j.sjbs.2016.10.015.

36. Sriha Belguith A, Beltaief K, Msolli MA, Bouida W, Abroug H, Ben Fredj M, Zemni I, Grissa MH, Boubaker H; ESCor Investigators group; Hsairi M, Nouira S; ESCorT Investigators group. Management of acute coronary syndrome in emergency departments: A cross sectional multicenter study (Tunisia). BMC Emerg Med. 2018 Dec 3;18(1):50.
DOI: 10.1186/s12873-018-0201-6.

37. Lemkes JS, Janssens GN, van der Hoeven NW, van de Ven PM, Marques KMJ, Nap A, van Leeuwen MAH, Appelman YEA, Knaapen P, Verouden NJW, Allaart CP, Brinckman SL, Saraber CE, Plomp KJ, Timmer JR, Kedhi E, Hermanides RS, Meuwissen M, Schaap J, van der Weerdt AP, van Rossum AC, Nijveldt R, van Royen N. Timing of revascularization in patients with transient ST-segment elevation myocardial infarction: a randomized clinical trial. Eur Heart J. 2019 Jan 14;40(3):283-291.
DOI: 10.1093/eurheartj/ehy651.

38. Arora S, Stouffer GA, Kucharska-Newton A, Vaduganathan M, Qamar A, Matsushita K, Kolte D, Reynolds HR, Bangalore S, Rosamond WD, Bhatt DL, Caughey MC. Fifteen-Year Trends in Management and Outcomes of Non-ST-Segment-Elevation Myocardial Infarction Among Black and White Patients: The ARIC Community Surveillance Study, 2000-2014. J Am Heart Assoc. 2018 Oct 2;7(19):e010203.
Doi: 10.1161/JAHA.118.010203.

39. Puymirat E, Bonaca M, Fumery M, Tea V, Aissaoui N, Lemesles G, Bonello L, Ducrocq G, Cayla G, Ferrières J, Schiele F, Simon T, Danchin N; FAST-MI investigators. Atherothrombotic risk stratification after acute myocardial infarction: The Thrombolysis in Myocardial Infarction Risk Score for Secondary Prevention in the light of the French Registry of Acute ST Elevation or non-ST Elevation Myocardial Infarction registries. Clin Cardiol. 2019 Feb;42(2):227-234.
DOI: 10.1002/clc.23131.

40. Güntekin Ü, Tosun V, Kilinç AY, Saydam G, Korucuk N, Bozdemir MN. ST segment elevation myocardial infarction (STEMI) patients are more likely to achieve lipid-lowering treatment goals: A retrospective analysis of patients presenting with first acute coronary syndromes. Medicine (Baltimore). 2018 Sep;97(39):e12225.
DOI: 10.1097/MD.0000000000012225.

41. Sanchis J, Ariza-Solé A, Abu-Assi E, Alegre O, Alfonso F, Barrabés JA, Baz JA, Carol A, Díez Villanueva P, García Del Blanco B, Elízaga J, Fernandez E, García Del Egido A, García Picard J, Gómez Blázquez I, Gómez Hospital JA, Hernández-Antolín R, Llibre C, Marín F, Martí Sánchez D, Martín R, Martínez Sellés M, Miñana G, Morales Gallardo MJ, Núñez J, Pérez de Prado A, Pinar E, Sanmartín M, Sionis A, Villa A, Marrugat J, Bueno H. Invasive Versus Conservative Strategy in Frail Patients With NSTEMI: The MOSCA-FRAIL Clinical Trial Study Design. Rev Esp Cardiol (Engl Ed). 2019 Feb;72(2):154-159. English, Spanish.
DOI: 10.1016/j.rec.2018.02.007.

42. Bønaa KH, Steigen T. Coronary angiography in non-ST-elevation acute myocardial infarction - whom and when? Tidsskr Nor Laegeforen. 2017 Nov 13;137(22). English, Norwegian.
DOI: 10.4045/tidsskr.17.0492.

43. Sanchis J, Núñez J, Bodí V, Núñez E, García-Alvarez A, Bonanad C, Regueiro A, Bosch X, Heras M, Sala J, Bielsa O, Llácer A. Influence of comorbid conditions on one-year outcomes in non-ST-segment elevation acute coronary syndrome. Mayo Clin Proc. 2011 Apr;86(4):291-6.
DOI: 10.4065/mcp.2010.0702.

44. Elbadawi A, Elgendy IY, Mahmoud K, Barakat AF, Mentias A, Mohamed AH, Ogunbayo GO, Megaly M, Saad M, Omer MA, Paniagua D, Abbott JD, Jneid H.

Temporal Trends and Outcomes of Mechanical Complications in Patients with Acute Myocardial Infarction. JACC Cardiovasc Interv. 2019 Sep 23; 12(18):1825-1836.
DOI: 10.1016/j.jcin.2019.04.039.

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