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Approach to the adult patient with non-traumatic chest pain in the emergency department

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ABSTRACT

Chest pain is one of the most common reasons for presentation to the emergency department and may be attributable to a wide spectrum of cardiac and non-cardiac etiologies. Given that this clinical manifestation may indicate life-threatening conditions—such as acute coronary syndrome, aortic dissection, pulmonary embolism, pneumothorax, pericardial tamponade, and mediastinitis—a prompt and structured diagnostic approach is essential. Clinical data including history, physical examination findings, vital signs, and prior test results play a pivotal role in risk stratification and guiding the diagnostic algorithm. Electrocardiography, cardiac biomarkers, D-dimer testing, chest radiography, and—when indicated—advanced imaging modalities such as computed tomography, magnetic resonance imaging, and echocardiography, contribute significantly to diagnostic accuracy. This review discusses a systematic approach to adult patients presenting with non-traumatic chest pain in the emergency setting, and summarizes key clinical scenarios and therapeutic strategies in differential diagnosis based on current literature.

Keywords: Emergency department, non-traumatic chest pain, diagnostic approach

INTRODUCTION

Chest pain is among the most frequent presenting complaints in the emergency department and is associated with a broad range of clinical conditions. Patients may exhibit symptoms related to the cardiovascular, pulmonary, gastrointestinal, or musculoskeletal systems. The primary responsibility of emergency physicians is the early identification and exclusion of potentially life-threatening causes of chest pain. Notably, patients with serious underlying etiologies may present with normal vital signs and non-specific physical examination findings, thereby creating a misleading impression of clinical stability. This review aims to provide a systematic approach to the evaluation of adult patients presenting to the emergency department with non-traumatic chest pain, with a focus on both life-threatening and commonly encountered causes. Topics related to the outpatient evaluation of clinically stable patients are beyond the scope of this review.

EPIDEMIOLOGY

Chest pain ranks as the second most common reason for adult visits to emergency departments in the United States, accounting for approximately 6–7% of all annual emergency presentations.[1] This corresponds to an estimated 7 to 8 million visits per year. Among all chest pain presentations, a life-threatening underlying pathology is identified in approximately 6% of cases, with the vast majority (over 90%) of these attributable to acute coronary syndrome.[2] Moreover, the likelihood of diagnosing a life-threatening condition increases significantly with advancing age.

INITIAL ASSESSMENT AND STABILIZATION

In patients presenting to the emergency department with chest pain, the initial priority is the rapid assessment of hemodynamic status and prompt identification of life-threatening conditions to facilitate immediate intervention. This process begins with a focused history and physical examination. In cases of non-traumatic chest pain, critical diagnoses that must be promptly excluded include acute coronary syndrome, aortic dissection, pulmonary embolism (PE), tension pneumothorax, cardiac tamponade, mediastinitis, myocarditis, Takotsubo cardiomyopathy, and perforated peptic ulcer. These conditions may present with symptoms that mimic those of more benign etiologies. Importantly, patients with severe underlying pathology may exhibit normal vital signs, whereas those with less serious causes may present with marked physiological disturbances. Therefore, findings such as abnormal vital signs, respiratory or circulatory distress, signs of hypoperfusion, sudden and severe thoracic or abdominal pain, or pulse discrepancies between extremities should be considered indicators of a potentially serious condition, and treatment should not be delayed while awaiting definitive diagnosis.

INITIAL MANAGEMENT STRATEGIES IN HEMODYNAMIC INSTABILITY

In patients presenting with hemodynamic instability or severe chest pain, rapid resuscitation measures should be implemented as follows:

Airway and ventilatory support: The need for invasive or non-invasive ventilation should be promptly assessed based on clinical findings.

Oxygen therapy: Supplemental oxygen should be administered only when indicated, with a target oxygen saturation typically between 90–92%. However, in patients with acute coronary syndrome who have normal oxygen saturation, routine oxygen supplementation is not recommended.

Intravenous access and laboratory sampling: Rapid establishment of intravenous access is essential to initiate diagnostic work-up without delay, and blood samples should be obtained for necessary laboratory investigations. In cases of suspected acute coronary syndrome, cardiac biomarkers—particularly high-sensitivity troponin—should be evaluated. If PE is suspected, D-dimer testing should be incorporated into the diagnostic algorithm in conjunction with appropriate clinical scoring systems.

Cardiac monitoring and ECG: Continuous cardiac monitoring should be initiated, and a 12-lead electrocardiogram (ECG) should be obtained at the earliest opportunity.[3]

Arrhythmia management: For life-threatening arrhythmias, advanced cardiac life support (ACLS) protocols should be followed.

Circulatory support: In cases of shock, immediate treatment of the underlying cause is paramount (e.g., emergency thoracostomy for tension pneumothorax, pericardiocentesis for tamponade).

Aspirin administration: In the absence of suspected aortic dissection or gastrointestinal perforation, 162–325 mg of non-enteric coated aspirin should be administered by chewing.

Chest radiography: A portable chest X-ray should be obtained in all patients presenting with chest pain. However, it should be noted that certain critical diagnoses may not present with classic radiographic findings.

Bedside ultrasonography: Point-of-care ultrasound is valuable in rapidly identifying life-threatening conditions in hemodynamically unstable patients. It aids in detecting pericardial effusion, right ventricular (RV) dilation, myocardial dysfunction, pneumothorax, and aortic enlargement.

ELECTROCARDIOGRAPHY AND ITS ROLE IN INITIAL ASSESSMENT

In all patients presenting to the emergency department with chest pain, early evaluation for potential cardiac etiologies is of paramount importance. In this context, the standard 12-lead ECG serves as the primary diagnostic tool, particularly in individuals at risk for acute coronary syndrome (ACS). According to the guidelines of the American College of Cardiology (ACC) and the American Heart Association (AHA), an ECG should be obtained and interpreted within the first 10 minutes of emergency department presentation. While there is no universally defined age threshold for ECG acquisition in younger adults, some studies advocate for routine ECG assessment in individuals over the age of 30.[4] Given its low cost, ease of use, and non-invasive nature, ECG is considered a prudent diagnostic measure even in patients with a low pre-test probability of cardiac disease. In such cases, performing an ECG is often preferable to risk missing an early diagnosis.

Although ECG is a readily available and rapid diagnostic tool for the evaluation of ACS, its sensitivity for detecting acute myocardial infarction (AMI) is limited. A single ECG recording may identify less than half of myocardial infarction (MI) cases. Among patients with normal or non-specific ECG findings, the incidence of AMI ranges from 1% to 5%, while unstable angina may occur in approximately 4% to 23% of cases.[5,6] Serial ECG assessments can enhance diagnostic accuracy, particularly when early signs such as hyperacute T waves are present. If the initial ECG is non-diagnostic but symptoms persist and clinical suspicion remains high, repeat ECGs should be performed. Management decisions should be guided by a combination of ECG findings and symptom assessment. When prior ECG records are available, current findings must be compared to determine whether changes are new.

ECG FINDINGS ASSOCIATED WITH LIFE-THREATENING DIAGNOSES

In patients presenting to the emergency department with chest pain, exclusion of cardiac causes is of critical importance. A 12-lead ECG should be obtained and interpreted within the first 10 minutes of arrival, serving as an essential tool for early diagnosis, particularly in individuals at risk for ACS. Due to its low cost, rapid availability, and non-invasive nature, ECG is generally recommended even in patients with a low likelihood of cardiac etiology.

However, the sensitivity of ECG for diagnosing AMI is limited; a single recording may detect fewer than half of all AMI cases. Early changes such as hyperacute T waves can be subtle and easily overlooked, underscoring the importance of serial ECG assessments to improve diagnostic sensitivity. A normal ECG does not definitively rule out AMI or unstable angina. Therefore, current findings should be interpreted in conjunction with clinical features and compared to previous ECGs when available.

Key ECG findings suggestive of life-threatening conditions include ST-segment elevations consistent with ST-elevation myocardial infarction (STEMI), new-onset left bundle branch block, signs of posterior AMI (ST depression and tall R waves in leads V1–V4, ST elevation in leads V7–V9), and the "de Winter" pattern. Diffuse ST-segment depression and T wave abnormalities may also reflect underlying myocardial ischemia.

In association with other critical diagnoses, certain characteristic ECG patterns may be observed. In pericarditis, diffuse ST-segment elevations accompanied by PR-segment depression are typical findings. PE may present with the $S_1Q_3T_3$ pattern, right bundle branch block, or right axis deviation.[7] In cases of pericardial tamponade, low voltage QRS complexes and electrical alternans can be noted. Ventricular arrhythmias such as ventricular tachycardia or ventricular fibrillation, as well as conduction blocks, may occur following STEMI. Sinus tachycardia, while non-specific, may be a common manifestation in several life-threatening conditions including PE, cardiac tamponade, and aortic dissection. Therefore, a normal ECG should not be interpreted as definitive exclusion of serious underlying pathology.

CHEST RADIOGRAPHY AND ITS ROLE IN INITIAL ASSESSMENT

Chest radiography is a frequently utilized, rapid, and widely accessible imaging modality in the initial evaluation of patients presenting to the emergency department with chest pain. Although it can aid in the identification of certain life-threatening conditions, it is often insufficient as a standalone diagnostic tool; thus, radiographic findings should always be interpreted in conjunction with the clinical context.

Pneumothorax is typically recognized on upright chest radiographs by the presence of a visible pleural line and a radiolucent space between the pleura and the chest wall. In cases of large air leaks, lung collapse, mediastinal shift, and tracheal deviation may indicate tension pneumothorax. Pleural effusion is generally observed as blunting of the costophrenic angles or hemithorax opacification; in large effusions, mediastinal structures may be displaced toward the contralateral side.

PE often presents with a normal chest radiograph. However, in certain cases, rare and nonspecific findings such as Hampton's hump or the Westermark sign may be observed. Pulmonary congestion or acute heart failure of cardiac origin may manifest as cardiomegaly, pulmonary venous engorgement, Kerley B lines, and alveolar edema patterns on imaging.[8]

Aortic dissection or aneurysm may be suggested on chest radiography by findings such as mediastinal widening, irregularity of the aortic contour, tracheal deviation, and inferior displacement of the left main bronchus; however, computed tomography (CT) angiography is required for definitive diagnosis.[9] In cases of pericardial tamponade or large effusions, the cardiac silhouette may appear enlarged and globular, often described as a "flask-shaped" configuration, though echocardiography is essential for confirmation. Stress cardiomyopathy typically presents with a normal chest radiograph, although cardiomegaly and signs of interstitial pulmonary edema may be present if heart failure coexists. In esophageal rupture and mediastinitis, radiographic clues may include mediastinal free air, subcutaneous emphysema, and air tracking around the trachea; a left-sided pleural effusion may also be observed.

In conclusion, while chest radiography may offer important clues for certain critical diagnoses, its limited sensitivity often renders it insufficient as a standalone tool. Therefore, it should always be interpreted in conjunction with clinical findings and, when necessary, supplemented by advanced imaging modalities.

SUBSEQUENT EVALUATION

In patients presenting to the emergency department with chest pain, a definitive diagnosis is often not established during the initial evaluation, which includes triage, history taking, and physical examination. Therefore, the diagnostic process must continue in parallel with simultaneous therapeutic interventions. A detailed clinical history—including comorbid conditions and the specific characteristics of the presenting symptoms—provides critical information for narrowing the differential diagnosis and identifying potentially life-threatening causes. Physical examination findings, with a focus on vital signs and cardiac or pulmonary indicators, can further guide diagnostic reasoning. Unless a clearly non-cardiac or non-pulmonary etiology (such as herpes zoster) is identified, both electrocardiography and chest radiography should be routinely included in the assessment.

HISTORY OF PRESENT ILLNESS

In patients with chest pain, distinguishing the affected organ system based solely on symptom history can be challenging. The overlapping afferent neural pathways of intrathoracic structures often result in similar or non-specific symptom presentations. Thus, while symptom characteristics may provide diagnostic clues, they are rarely sufficient for establishing an early diagnosis in isolation. Atypical presentations are common and may be misinterpreted, potentially leading to diagnostic delays and adverse outcomes.[10,11] Key aspects to be addressed during history taking include the following:

Onset and character of pain: Sudden and severe chest pain is characteristic of critical conditions such as aortic dissection, pneumothorax, and PE. Most patients with aortic dissection report abrupt onset of symptoms.[12] Pneumothorax often occurs spontaneously at rest, without a clear precipitating event.

Duration and episodic nature: Whether the pain is continuous or episodic, along with its duration and frequency, holds diagnostic value. Additionally, determining the precise onset of symptoms is essential for the appropriate interpretation of cardiac biomarkers.

Precipitating events: A history of recent trauma, surgery, endoscopic procedures, or prolonged immobilization may raise suspicion for conditions such as PE or esophageal rupture. However, a classic predisposing event is not always present.

Relation to exertion: Pain triggered or worsened by physical exertion is commonly associated with ACS. While stable

angina tends to occur predictably with exertion, unstable angina may arise at rest or with minimal physical activity.

Quality and radiation of pain: Cardiac chest pain is typically described as a sensation of pressure, tightness, or heaviness and may radiate to the shoulders, arms, neck, jaw, back, or epigastric region. Radiation to the shoulders or exertion-induced pain should raise concern for ACS.

Non-ischemic causes: Sharp, stabbing, pleuritic, or position-dependent pain is more often associated with non-cardiac etiologies. Pericardial pain typically worsens in the supine position and improves when leaning forward. Pneumothorax may initially present with sharp pain that becomes dull over time. Gastrointestinal causes, on the other hand, frequently produce a burning sensation.

ASSOCIATED SYMPTOMS

Symptoms accompanying chest pain can offer valuable clues to guide the diagnostic process. Although diaphoresis, nausea, and vomiting are commonly associated with ACS, they may also be present in aortic dissection, PE, or esophageal spasm.[13] Dyspnea is a prominent feature in conditions such as PE, pneumothorax, and pneumonia. Hemoptysis may suggest PE or valvular heart disease, whereas cough and fever are more indicative of infectious causes such as bronchitis. Unilateral extremity pain and swelling raise concern for deep vein thrombosis, which may lead to PE. Fever may also accompany pericarditis, myocarditis, and, less commonly, MI.

RISK FACTORS

Major risk factors for ACS include advanced age, male sex, family history of cardiovascular disease, hypertension, dyslipidemia, diabetes mellitus, cigarette smoking, and a history of coronary artery disease.[14] However, the absence of these factors does not entirely exclude the possibility of serious cardiac pathology. Stimulant substances such as cocaine and amphetamines may provoke severe cardiovascular complications, particularly in younger individuals.

Key risk factors for aortic dissection include hypertension, connective tissue disorders such as Marfan syndrome, bicuspid aortic valve, pregnancy, and prior aortic surgery. In younger patients, underlying genetic or structural predispositions are more commonly implicated.

PE risk is elevated in the presence of recent surgical procedures, prolonged immobilization, central venous catheterization, malignancy, thrombophilia, pregnancy, and hormonal therapies.[15] In younger individuals, an obvious risk factor may be absent; however, further evaluation may reveal underlying genetic or hematologic predispositions, such as Factor V Leiden mutation.

Tobacco use is a significant risk factor for both cardiovascular and pulmonary diseases and is also an independent risk factor for spontaneous pneumothorax. The risk of pneumothorax is increased in individuals with HIV infection and in those with *Pneumocystis jirovecii* pneumonia. In women with endometriosis, catamenial pneumothorax—typically occurring during menstruation—should be considered.[16] Thoracic pressure changes associated with activities such as SCUBA diving, as well as a prior history of pneumothorax, are known to increase the risk of recurrence; similarly, air travel may also contribute to recurrence risk.[17]

PREVIOUS DIAGNOSES AND INTERVENTIONS

Obtaining information about prior diagnostic evaluations for similar symptoms can significantly guide current clinical decision-making. A recent coronary CT angiography (CCTA) or invasive cardiac catheterization demonstrating normal or minimally stenotic coronary arteries substantially reduces the likelihood of ACS. For instance, patients found to have minimal or no coronary artery disease have been shown to have a 98% event-free survival rate over a 10-year follow-up period with respect to MI.[18] However, a recent negative stress test alone is not sufficient to rule out ACS in patients presenting with ongoing chest pain.

PHYSICAL EXAMINATION

In patients presenting with chest pain, physical examination is essential for both the assessment of vital signs and the early recognition of life-threatening conditions. Individuals with serious underlying etiologies often appear anxious, restless, and distressed, and may exhibit accompanying signs such as diaphoresis, tachypnea, or dyspnea. Any significant abnormalities in vital parameters should be addressed without delay, and appropriate emergency management protocols should be promptly initiated.

PHYSICAL EXAMINATION FINDINGS IN SPECIFIC DIAGNOSES

Acute aortic dissection may not always present with specific findings on physical examination. However, when the dissection involves major aortic branches, signs of end-organ ischemia may emerge, including MI, ischemic stroke, mesenteric ischemia, or limb ischemia. Although uncommon, the presence of pulse deficits or significant blood pressure discrepancies between the upper extremities can be diagnostically meaningful. According to data from the International Registry of Acute Aortic Dissection, aortic regurgitation murmur is present in 32% of cases, pulse deficits in 15%, signs of shock or cardiac tamponade in 8%, acute heart failure in 7%, and cerebrovascular events in 5%. Additionally, up to 30% of patients may exhibit neurological manifestations such as Horner's syndrome, paraparesis, or paraplegia.[12]

In ACS, physical examination is often non-diagnostic, with patients typically presenting with minimal physical findings. However, the presence of pulmonary rales—either in conjunction with or independent of an S3 gallop—may suggest left ventricular dysfunction and associated congestive heart failure. Signs of right-sided heart failure, such as jugular venous distention, hepatojugular reflux, and peripheral edema, may be observed and can be associated with either ACS or PE. A new systolic murmur may indicate mechanical complications such as papillary muscle dysfunction or a ventricular septal defect. In pericarditis, the presence of a

characteristic pericardial friction rub on auscultation can provide a valuable diagnostic clue.

In patients with suspected PE, physical findings such as unilateral lower extremity swelling or localized wheezing may heighten clinical suspicion. However, it is important to note that extremity examinations are often unremarkable. In pneumothorax, diminished or absent breath sounds on the affected side represent the most frequently observed physical finding. Subcutaneous emphysema may be present but is relatively uncommon.

In certain cases, physical examination can support non-cardiac etiologies. For example, epigastric tenderness combined with positive fecal occult blood may indicate a gastrointestinal source of chest pain. Additionally, in patients with mediastinal emphysema, the presence of Hamman's sign—a crackling sound heard over the precordium with a stethoscope—may provide a diagnostic clue suggestive of esophageal rupture or pneumomediastinum.

TARGETED LABORATORY TESTING BASED ON CLINICAL SUSPICION

In patients presenting with chest pain, laboratory investigations should be guided by clinical suspicion and utilized to support the diagnostic process. Particularly in life-threatening cardiac and thromboembolic conditions, accurate interpretation of biomarkers is essential for prompt clinical decision-making.

Cardiac Biomarkers

Cardiac troponins are the most sensitive and specific indicators for the diagnosis of AMI. High-sensitivity troponin I or T assays typically begin to rise within 2–3 hours of symptom onset and peak around 12 hours. A single normal troponin level does not exclude early-stage AMI; however, a low initial value combined with a downward trend on serial testing may support early discharge in low-risk patients.[19-21] Elevated troponin levels may also be observed in non-ischemic cardiac conditions such as myocarditis, heart failure, or PE.

D-Dimer

In patients with suspected PE who are categorized as low-to-intermediate risk, D-dimer serves as a useful rule-out test due to its high sensitivity. However, D-dimer levels may be physiologically elevated in the presence of factors such as advanced age, malignancy, infection, recent surgery, and pregnancy. It may also aid in excluding aortic dissection, particularly when used in conjunction with the Aortic Dissection Detection Risk Score.[22]

Complete Blood Count

Leukocytosis may suggest infectious or inflammatory etiologies, including pneumonia, pericarditis, or mediastinitis. Anemia may be associated with serious conditions such as myocardial ischemia or aortic rupture.

BNP/NT-proBNP

These biomarkers are useful in suggesting acute heart failure. Low levels are valuable in ruling out the diagnosis. However, they must be interpreted within the clinical context, as values may be affected by age, renal impairment, or sepsis.

Coagulation Studies

In patients receiving anticoagulation therapy or at risk for bleeding, tests such as PT, aPTT, and INR should be obtained to assess coagulation status.

Basic Biochemical Tests

Electrolytes, renal function parameters, and serum creatinine levels are essential, particularly prior to procedures involving contrast media such as CT angiography or coronary angiography.

Liver Enzymes and Lipase

In patients presenting with epigastric or right upper quadrant pain, liver function tests and lipase levels are helpful in excluding hepatobiliary pathology or pancreatitis.

Arterial Blood Gas (ABG)

Although sometimes used in the evaluation of suspected PE, ABG has limited diagnostic utility. Assessment of the alveolar-arterial oxygen gradient offers only marginal diagnostic sensitivity and is not routinely recommended.

IMAGING MODALITIES

In patients with chest pain in whom initial ECG and laboratory tests are non-diagnostic, advanced imaging plays a pivotal role in the diagnostic pathway. CT is particularly valuable in the evaluation of non-ACS etiologies due to its broad diagnostic capabilities. CT can assess aortic dissection, PE, pneumothorax, pneumonia, and mediastinal or chest wall pathologies, and may also reveal alternative diagnoses when performed for suspected PE or dissection.

Aortic Dissection

CT angiography is the first-line imaging modality due to its rapid acquisition and widespread availability. Magnetic resonance imaging (MRI) offers superior structural assessment of the aorta but is limited in emergent settings. Transesophageal echocardiography (TEE) may provide reliable diagnostic information, especially in hemodynamically unstable patients when performed by experienced operators. The choice of imaging should be guided by clinical status, contrast tolerance, and institutional resources.

Pulmonary Embolism

Contrast-enhanced CT pulmonary angiography (CTPA) is considered the gold standard for diagnosing PE. While subsegmental emboli can be visualized, their clinical relevance remains controversial. In cases with poor image quality or contraindications to contrast, ventilation/perfusion (V/Q) scintigraphy may be employed. Lower extremity Doppler ultrasonography is also helpful in cases with suspected deep vein thrombosis.

Acute Coronary Syndrome (ACS)

In low-to-intermediate risk and clinically stable patients, CCTA is effective for ruling out ACS.[23] With high-resolution CT scanners, obstructive lesions can be accurately identified.

Additionally, CCTA can be utilized within the "triple rule-out protocol" to simultaneously exclude PE and aortic dissection; however, increased radiation exposure must be considered.[24]

Echocardiography and Cardiac Inflammation

Transthoracic echocardiography (TTE) is the primary modality for diagnosing pericarditis, myocarditis, and pericardial effusion. Myocarditis may present with global ventricular dysfunction, whereas apical ballooning is typical in Takotsubo cardiomyopathy. TTE is also useful in detecting signs of tamponade and regional wall motion abnormalities.

Gastrointestinal and Mediastinal Pathologies

For rare but serious causes such as esophageal rupture, mediastinitis, or perforated peptic ulcer, thoracic and/or abdominal CT can support the diagnosis by demonstrating free air, fluid collections, or signs of inflammation. These entities represent critical clinical emergencies requiring thorough and prompt evaluation.

LIFE-THREATENING CONDITIONS AND MANAGEMENT APPROACHES

Certain conditions in patients presenting to the emergency department with chest pain require prompt diagnosis and immediate intervention to prevent potentially fatal outcomes. Early recognition and management are therefore critical in these scenarios.

Acute Coronary Syndrome (ACS)

ACS is one of the most critical cardiac causes of chest pain. It may present with atypical symptoms, particularly in the elderly, women, or patients with diabetes, and should not be excluded based solely on a single ECG or troponin measurement. Diagnosis should be supported by high-sensitivity troponin assays and serial ECGs. Treatment includes antiplatelet and anticoagulant therapy, beta-blockers, and reperfusion strategies when indicated—such as primary percutaneous coronary intervention or coronary artery bypass grafting.

Aortic Dissection and Aneurysm

These conditions are typically seen in hypertensive patients or younger individuals with connective tissue disorders. Aortic dissection should be suspected in the presence of sudden, tearing chest pain accompanied by pulse or blood pressure discrepancies. CT angiography is the primary imaging modality for diagnosis, while TEE may be preferred in unstable patients. Management begins with anti-impulse therapy aimed at reducing heart rate and blood pressure. If surgical indications are present, urgent operative intervention is required.

Pulmonary Embolism (PE)

PE, a consequence of venous thromboembolism, presents with a wide clinical spectrum. Patients may exhibit nonspecific findings such as dyspnea, tachycardia, and hypoxia. In cases with suspected PE, clinical risk stratification should be performed using validated algorithms such as the Wells score and PERC criteria; diagnosis should then be confirmed with D-dimer testing and CTPA when appropriate.

Bedside ultrasonography and particularly echocardiography can provide valuable diagnostic insights in hemodynamically unstable patients. In appropriate clinical scenarios, the presence of RV dilation or dysfunction demonstrates approximately 50% sensitivity and 83% specificity for PE.[25] Notably, McConnell's sign—characterized by akinesia or hypokinesia of the RV free wall with preserved apical motion—is considered more specific for PE compared to general RV dysfunction.[26]

While thrombolytic therapy or embolectomy may be considered in hemodynamically unstable patients, anticoagulation remains the mainstay of treatment in hemodynamically stable individuals.

Pneumothorax

Spontaneous or secondary pneumothorax can also be life-threatening in patients presenting with chest pain and dyspnea. In the absence of trauma, spontaneous pneumothorax is commonly seen in tall, thin young males or individuals with underlying lung disease. In cases of tension pneumothorax, diagnosis is clinical, and immediate needle thoracostomy should be performed without delay for imaging. In stable patients, management options include chest tube placement, needle aspiration, or observation depending on clinical status and pneumothorax size.

Mediastinitis

Mediastinitis, particularly when secondary to esophageal perforation, surgical interventions, or odontogenic infections, carries a high risk of mortality. Diagnosis is typically established via CT, and delays in identification significantly increase the risk of adverse outcomes. Early initiation of broad-spectrum intravenous antibiotics is essential, and timely consultation with cardiothoracic surgery is strongly recommended.[27,28]

Pericardial Tamponade

Tamponade results from the accumulation of fluid in the pericardial sac, which impairs cardiac filling and may lead to obstructive shock. Bedside echocardiography allows for rapid diagnosis. Emergent pericardiocentesis is a life-saving intervention that can restore hemodynamic stability.

Myocarditis and Stress Cardiomyopathy

Myocarditis may result from a variety of causes, most commonly viral infections, and can lead to heart failure or arrhythmias. Diagnosis is supported by echocardiography, cardiac biomarkers, and, when needed, cardiac MRI. Takotsubo cardiomyopathy, typically triggered by emotional or physical stress, mimics MI but is characterized by the absence of obstructive coronary artery disease. Management is generally supportive.

Perforated Peptic Ulcer

Although uncommon, perforated peptic ulcers may present with epigastric pain radiating to the chest, mimicking other thoracic emergencies. Diagnosis is typically established by CT. Prompt initiation of intravenous antibiotics and early surgical consultation are essential components of management.

CONCLUSION

In adult patients presenting to the emergency department with non-traumatic chest pain, a rapid, systematic, and targeted evaluation is crucial for the early recognition and management of life-threatening conditions. Diagnostic tests guided by clinical history and physical examination findings can significantly reduce unnecessary interventions while improving outcomes by lowering morbidity and mortality. Therefore, a multidisciplinary approach and adherence to structured clinical algorithms are fundamental to the effective evaluation of chest pain in the emergency setting.

ETHICAL DECLARATIONS

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

The author declares that they solely conducted the design, execution, analysis, and writing of the manuscript, and approved the final version.

REFERENCES

1. Cairns C, Kang K. National Hospital Ambulatory Medical Care Survey: 2021 emergency department summary tables. Published 2023. Accessed 2024. Available from: https://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHAMCS/doc21-ed-508.pdf
2. Stepinska J, Lettino M, Ahrens I, et al. Diagnosis and risk stratification of chest pain patients in the emergency department: focus on acute coronary syndromes. A position paper of the acute cardiovascular care association. *Eur Heart J Acute Cardiovasc Care.* 2020;9(1):76-89. doi:10.1177/2048872619885346
3. Gulati M, Levy PD, Mukherjee D, et al. 2021 AHA/ACC/ASE/CHEST/SAEM/SCCT/SCMR guideline for the evaluation and diagnosis of chest pain: a report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. *J Am Coll Cardiol.* 2021;78(22):e187-e285. doi:10.1016/j.jacc.2024.09.024
4. Glickman SW, Shofer FS, Wu MC, et al. Development and validation of a prioritization rule for obtaining an immediate 12-lead electrocardiogram in the emergency department to identify ST-elevation myocardial infarction. *Am Heart J.* 2012;163(3):372-382. doi:10.1016/j.ahj.2011.10.021
5. Hathaway WR, Peterson ED, Wagner GS, et al. Prognostic significance of the initial electrocardiogram in patients with acute myocardial infarction. GUSTO-I Investigators. Global Utilization of Streptokinase and t-PA for occluded coronary arteries. *JAMA.* 1998;279(5):387-391. doi:10.1001/jama.279.5.387
6. Selker HP, Zalenski RJ, Antman EM, et al. An evaluation of technologies for identifying acute cardiac ischemia in the emergency department: a report from a National Heart Attack Alert Program Working Group. *Ann Emerg Med.* 1997;29(1):13-87. doi:10.1016/s0196-0644(97)70298-1
7. Rodger M, Makropoulos D, Turek M, et al. Diagnostic value of the electrocardiogram in suspected pulmonary embolism. *Am J Cardiol.* 2000;86(7):807-809. doi:10.1016/s0002-9149(00)01090-0
8. Zuin M, Rigatelli G, Zonzin P, Roncon L. Chest X-ray in acute pulmonary embolism: forgiven but not forgotten. *Intensive Care Med.* 2019;45(12):1822-1823. doi:10.1007/s00134-019-05661-7
9. von Kodolitsch Y, Schwartz AG, Nienaber CA. Clinical prediction of acute aortic dissection. *Arch Intern Med.* 2000;160(19):2977-2982. doi:10.1001/archinte.160.19.2977
10. Pope JH, Aufderheide TP, Ruthazer R, et al. Missed diagnoses of acute cardiac ischemia in the emergency department. *N Engl J Med.* 2000;342(16):1163-1170. doi:10.1056/NEJM200004203421603
11. Gupta M, Tabas JA, Kohn MA. Presenting complaint among patients with myocardial infarction who present to an urban, public hospital emergency department. *Ann Emerg Med.* 2002;40(2):180-186. doi:10.1067/mem.2002.126396
12. Hagan PG, Nienaber CA, Isselbacher EM, et al. The International Registry of Acute Aortic Dissection (IRAD): new insights into an old disease. *JAMA.* 2000;283(7):897-903. doi:10.1001/jama.283.7.897
13. Goodacre S, Locker T, Morris F, Campbell S. How useful are clinical features in the diagnosis of acute, undifferentiated chest pain? *Acad Emerg Med.* 2002;9(3):203-208. doi:10.1111/j.1553-2712.2002.tb00245.x
14. Fanaroff AC, Rymer JA, Goldstein SA, Simel DL, Newby LK. Does this patient with chest pain have acute coronary syndrome? The rational clinical examination systematic review. *JAMA.* 2015;314(18):1955-1965. doi:10.1001/jama.2015.12735
15. Mantha S, Karp R, Raghavan V, Terrin N, Bauer KA, Zwicker JI. Assessing the risk of venous thromboembolic events in women taking progestin-only contraception: a meta-analysis. *BMJ.* 2012;345:e4944. doi:10.1136/bmj.e4944
16. Joseph J, Sahn SA. Thoracic endometriosis syndrome: new observations from an analysis of 110 cases. *Am J Med.* 1996;100(2):164-170. doi:10.1016/s0002-9343(97)89454-5
17. Henry M, Arnold T, Harvey J; Pleural Diseases Group, Standards of Care Committee, British Thoracic Society. BTS guidelines for the management of spontaneous pneumothorax. *Thorax.* 2003;Suppl 2 (Suppl 2):ii39-52. doi:10.1136/thorax.58.suppl_2.ii39
18. Papanicolaou MN, Califf RM, Hlatky MA, et al. Prognostic implications of angiographically normal and insignificantly narrowed coronary arteries. *Am J Cardiol.* 1986;58(13):1181-1187. doi:10.1016/0002-9149(86)90378-4
19. Hollander JE, Than M, Mueller C. State-of-the-art evaluation of emergency department patients presenting with potential acute coronary syndromes. *Circulation.* 2016;134(7):547-564. doi:10.1161/CIRCULATIONAHA.116.021886
20. Mahler SA, Riley RF, Hiestand BC, et al. The HEART Pathway randomized trial: identifying emergency department patients with acute chest pain for early discharge. *Circ Cardiovasc Qual Outcomes.* 2015;8(2):195-203. doi:10.1161/CIRCOUTCOMES.114.001384
21. Hollander JE. Managing troponin testing. *Ann Emerg Med.* 2016;68(6):690-694. doi:10.1016/j.annemergmed.2016.05.023
22. Nazerian P, Mueller C, Soeiro AM, et al. Diagnostic accuracy of the aortic dissection detection risk score plus D-dimer for acute aortic syndromes: the ADvISED prospective multicenter study. *Circulation.* 2018;137(3):250-258. doi:10.1161/CIRCULATIONAHA.117.029457
23. Litt HI, Gatsonis C, Snyder B, et al. CT angiography for safe discharge of patients with possible acute coronary syndromes. *N Engl J Med.* 2012;366(15):1393-1403. doi:10.1056/NEJMoa1201163
24. Ayaram D, Bellolio MF, Murad MH, et al. Triple rule-out computed tomographic angiography for chest pain: a diagnostic systematic review and meta-analysis. *Acad Emerg Med.* 2013;20(9):861-871. doi:10.1111/acem.12210
25. Fields JM, Davis J, Girson L, et al. Transthoracic echocardiography for diagnosing pulmonary embolism: a systematic review and meta-analysis. *J Am Soc Echocardiogr.* 2017;30(7):714-723.e4. doi:10.1016/j.echo.2017.03.004
26. McConnell MV, Solomon SD, Rayan ME, Come PC, Goldhaber SZ, Lee RT. Regional right ventricular dysfunction detected by echocardiography in acute pulmonary embolism. *Am J Cardiol.* 1996;78(4):469-473. doi:10.1016/s0002-9149(96)00339-6
27. Makeieff M, Gresillon N, Berthet JP, et al. Management of descending necrotizing mediastinitis. *Laryngoscope.* 2004;114(4):772-775. doi:10.1097/00005537-200404000-00035
28. Sancho LM, Minamoto H, Fernandez A, Sennes LU, Jatene FB. Descending necrotizing mediastinitis: a retrospective surgical experience. *Eur J Cardiothorac Surg.* 1999;16(2):200-205. doi:10.1016/s1010-7940(99)00168-2