Chapter 62
Approach to Chest Pain in the ICU

62.1 Introduction

Chest pain in the intensive care unit (ICU) is a critical symptom that demands a swift and systematic approach to identify potentially life-threatening conditions. Differentiating between cardiac and noncardiac causes is of paramount importance, and utilizing structured assessment tools can significantly enhance diagnostic accuracy. The pain can be visceral or somatic. Visceral pain is usually dull and over a larger area without any localization; whereas somatic pain is usually sharp, stabbing, and localized to a specific spot/area (dermatomal distribution). Importantly, clinicians must recognize that chest pain presentations can vary across different populations. Women, for instance, may experience symptoms beyond chest pain, such as nausea, fatigue, or shortness of breath, which can lead to underdiagnosis. Older adults often present with atypical symptoms like shortness of breath or confusion rather than chest pain alone. This chapter presents a comprehensive algorithm for evaluating chest pain in the ICU, incorporating current international guidelines, risk stratification methods, and considerations for diverse populations to ensure prompt and appropriate management [1, 2]. [Ref: Algorithm 62.1].

62.2 Primary Assessment (ABCDE Approach)

The initial step in managing a patient with chest pain in the ICU is the primary assessment using the Airway, Breathing, Circulation, Disability, and Exposure (ABCDE) approach. This systematic method aims to stabilize the patient and address any immediate life-threatening issues. Clinicians should assess vital signs and oxygenation status promptly, initiating resuscitation measures if necessary. In unstable patients, point-of-care ultrasound (POCUS) can be invaluable for rapidly evaluating conditions such as pneumothorax, pleural effusion, or cardiac tamponade.

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62.3 Initial Evaluation and Risk Stratification

Following stabilization, a detailed evaluation of the chest pain is essential. Employing the SOCRATES mnemonic—Site, Onset, Character, Radiation, Alleviating/Aggravating Factors, Timing, Exacerbating Factors, and Severity—provides a structured framework for characterizing the pain. Determining the exact location and nature of the pain, noting when and how it started, and identifying any radiation to other areas like the arm or jaw are crucial steps. Understanding what alleviates or aggravates the pain, whether it is constant or intermittent, and any triggers or activities that worsen it can offer vital clues. Quantifying the pain intensity using a severity scale aids in assessing the patient's condition.

62.3.1 Gender-Specific Considerations

It is important to recognize that women may present with symptoms beyond chest pain, such as nausea, fatigue, indigestion, or shortness of breath. These nonspecific symptoms can often lead to underdiagnosis of acute coronary syndromes (ACS) in women. Clinicians should maintain a high index of suspicion and consider cardiac causes even when chest pain is not the predominant symptom in female patients.

62.3.2 Age-Related Assessment

Older adults may present with atypical symptoms such as shortness of breath, confusion, syncope, or weakness rather than classic chest pain. Cognitive impairment and communication difficulties in this population may further obscure the clinical picture. A comprehensive evaluation, including collateral history from caregivers when necessary, is essential to avoid missing critical diagnoses in older patients who are at higher risk for ACS.

62.3.3 Risk Stratification Pathways

To categorize the patient's risk level for cardiac events, clinicians should apply validated risk stratification scores recommended by current guidelines, such as the HEART, EDACS, or TIMI scores. These clinical decision pathways are designed to streamline the diagnostic process and are adaptable to various settings, including the emergency department and outpatient clinics. Utilizing these tools helps in identifying patients who require urgent intervention versus those who can be managed conservatively.

62.4 Electrocardiogram (ECG) Evaluation

A 12-lead ECG should be performed within 10 min of the patient's presentation. The ECG is instrumental in detecting signs of ischemia or infarction, such as ST-segment changes, T-wave inversions, or new-onset left bundle branch block. New-onset ST elevation (in two or more contiguous leads) indicates STEMI (ST elevation myocardial infarction) and new-onset left bundle branch block, ST depression and pathological q waves signify non-ST-elevated myocardial infarction (NSTEMI). If the ECG indicates STEMI, immediate reperfusion therapy is indicated. For NSTEMI or unstable angina, further cardiac evaluation and management are necessary. It is important to note that a normal or nondiagnostic ECG does not rule out cardiac ischemia; therefore, continued evaluation is warranted.

62.5 Biomarker Assessment

High-sensitivity troponin testing is a cornerstone in the assessment of patients with chest pain. Initial troponin levels should be obtained promptly, with repeat measurements at appropriate intervals—typically around −3–4 h—to detect rising trends indicative of myocardial injury. Serial measurements enhance diagnostic accuracy, particularly in low-risk patients where initial levels may be normal.

62.6 Imaging and Additional Diagnostic Tests

Chest radiography is a valuable tool for identifying noncardiac causes of chest pain, such as pneumothorax, pneumonia, or aortic anomalies. Advanced imaging modalities should be selected based on the clinical scenario and the most probable diagnoses. Coronary computed tomography (CT) angiography may be considered for low- to intermediate-risk patients with possible cardiac chest pain and normal ECG and troponin results. Echocardiography is useful for evaluating structural heart diseases, wall motion abnormalities, or pericardial effusion.

For patients with symptoms suggestive of pulmonary embolism, a ventilation-perfusion (V/Q) scan or CT pulmonary angiography should be performed. In cases where aortic dissection is suspected—particularly in patients presenting with sudden, severe chest or back pain—aortic imaging with CT or magnetic resonance imaging (MRI) is essential for diagnosis.

62.7 Management Based on Identified Cause

62.7.1 Cardiac Causes

Acute Coronary Syndrome (ACS): Management of ACS involves both medical therapy and possible revascularization. Medical management includes initiation of oxygen therapy to target saturation levels >94%, administration of antiplatelet agents such as aspirin (160–325 mg orally chewable/dispersible) and P2Y12 inhibitors (Clopidogrel 300 mg orally), or Ticagrelor 180 mg orally if immediate percutaneous coronary intervention (PCI) or coronary arterial bypass graft (CABG) is not planned in next few hours. Heparin bolus of 60 U/kg (maximum 4000 U) followed by an initial infusion of 12 U/kg per hour (maximum 1000 U/hr) adjusted to maintain activated partial thromboplastin time (aPTT) at 1.5–2.0 times control (approximately 50–70 seconds) must be given intravenously to patients undergoing reperfusion therapy with alteplase, reteplase, or tenecteplase. LMWH might be considered as an acceptable alternative to UFH as ancillary therapy for patients less than 75 years of age who are receiving fibrinolytic therapy, provided that significant renal dysfunction (serum creatinine greater than 2.5 mg/dL in men or 2.0 mg/dL in women) is not present. Enoxaparin (30 mg IV bolus followed by 1.0 mg/kg subcutaneous injection every 12 h until hospital discharge) can be used alternatively in combination with full-dose tenecteplase. Sublingual NTG (Nitroglycerine) 0.4 mg or IV infusion (5–200 mcg/min) can be used for chest pain. However, it must be avoided if systolic blood pressure is below 90 mm Hg. Morphine can be used for pain at a dose of 2–4 mg IV followed by 1–2 mg IV every 15 min. Other opioids like fentanyl may also be used for pain relief. Beta-blockers to reduce myocardial oxygen demand and statins for lipid management are other supportive managements to be started along with antiplatelets and analgesia. Urgent percutaneous coronary intervention (PCI) is indicated for patients with STEMI. For those with NSTEMI, the decision to pursue PCI or continue with medical management is guided by risk stratification and patient stability.

Pericardial Tamponade: In cases of pericardial tamponade, prompt pericardiocentesis is required to relieve pressure on the heart and restore normal hemodynamics.

62.7.2 Noncardiac Causes

Pulmonary Embolism (PE): Management of PE depends on the patient's stability. Stable patients should receive anticoagulation therapy to prevent further clot formation. In unstable patients, where there is hemodynamic compromise, thrombolytic therapy or surgical embolectomy may be necessary.

Aortic Dissection: Treatment of aortic dissection is determined by the location of the dissection. Type A dissections, involving the ascending aorta, require emergency surgical repair. Type B dissections, involving the descending aorta, are typically managed medically with strict blood pressure control, with surgery reserved for complications or persistent pain.

Pneumothorax: In the event of a large or tension pneumothorax, insertion of a chest tube is required to re-expand the lung and alleviate symptoms.

Gastrointestinal Causes: For suspected gastroesophageal reflux disease (GERD), administration of proton pump inhibitors or gastrointestinal (GI) cocktails may provide symptom relief. However, clinicians should be cautious, as symptom relief does not confirm the diagnosis, and further evaluation may be necessary to rule out cardiac causes.

62.8 Conclusion

A systematic approach to chest pain in the ICU is essential for the rapid identification and management of life-threatening conditions. By utilizing structured assessment tools like SOCRATES for history taking, applying risk stratification scores such as HEART, EDACS, or TIMI, and adhering to current international guidelines, clinicians can improve diagnostic accuracy and patient outcomes. Recognizing the variations in chest pain presentations among women, older adults, and diverse populations is crucial to avoid underdiagnosis and ensure equitable care. Incorporating patient-centered care, shared decision-making, and patient education further enhances the therapeutic relationship and ensures that management strategies align with the patient's values and preferences.

Flowchart Summary: Approach to Chest Pain in the ICU

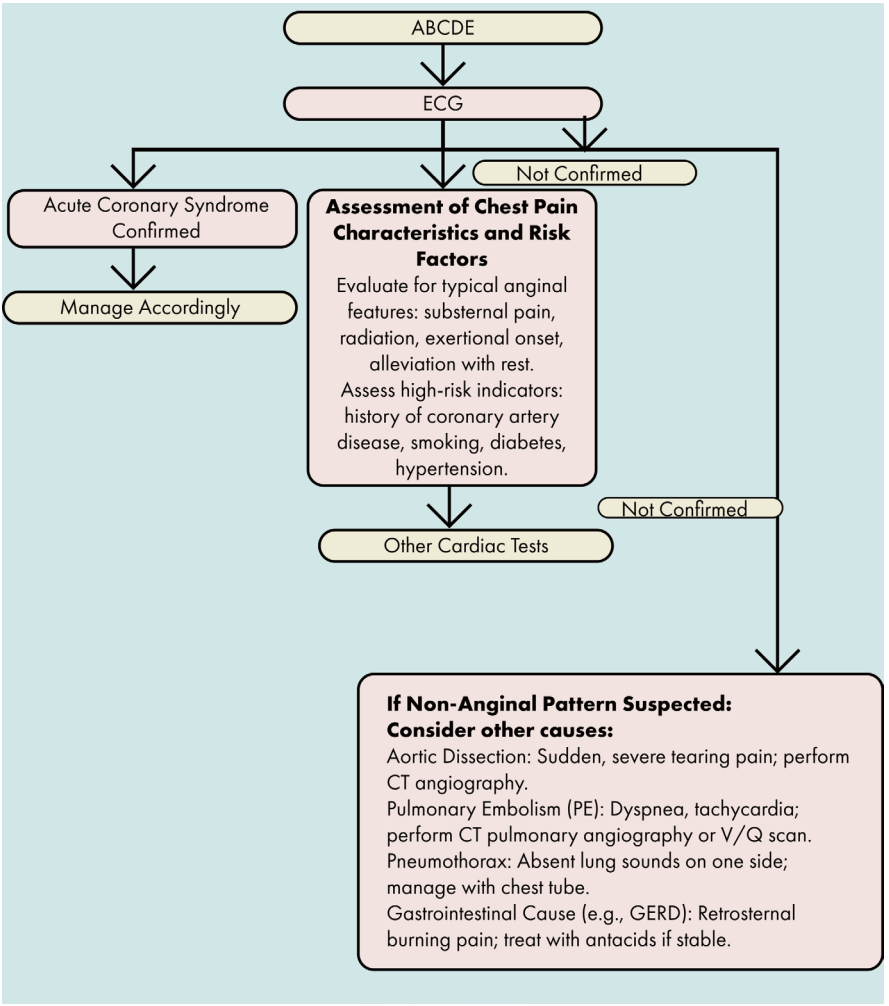
1. Primary Assessment (ABCDE) and Stabilization
   - Secure airway, support breathing, ensure adequate circulation.
   - Assess vital signs and hemodynamic stability.
   - Use POCUS if indicated for rapid assessment.
2. Initial Evaluation
   - Conduct a thorough history using the SOCRATES mnemonic.
   - Be attentive to gender-specific and age-related symptoms.
   - Apply risk stratification tools (HEART, EDACS, TIMI) as per guidelines.
   - Address cultural and language barriers to obtain accurate history.
3. ECG Evaluation
   - Perform an ECG within 10 min of presentation.
   - Interpret ECG findings promptly to guide management.

4. Biomarker Assessment
    - Obtain high-sensitivity troponin levels.
    - Repeat measurements to detect rising trends.
5. Further Diagnostic Testing
    - Select imaging modalities based on clinical suspicion.
    - Use echocardiography, coronary CT angiography, V/Q scan, CT pulmonary angiography, or CT/MRI as appropriate.
6. Management
    - Tailor treatment to the identified cause following current guidelines.
    - Initiate ACS protocols, manage noncardiac causes accordingly.

Key Points to Remember

- Prioritize Life-Threatening Conditions: Always address immediate threats to life and stabilize the patient before proceeding with further evaluation.
- Structured Assessment Tools: Utilize tools like SOCRATES and guideline-recommended risk stratification scores to enhance diagnostic accuracy.
- Consider Population-Specific Presentations: Be aware of gender-specific, age-related, and culturally influenced variations in symptom presentation to avoid underdiagnosis.
- Timely ECG and Biomarker Testing: Early ECG and troponin assessments are critical in diagnosing acute coronary syndromes.
- Selective Imaging Modalities: Choose imaging studies based on clinical suspicion to identify or rule out specific conditions efficiently.
- Cause-Specific Management: Follow current guidelines to tailor treatment to the identified cause, whether cardiac or noncardiac.

Algorithm 62.1: Approach to chest pain in the ICU



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