



## CHEST PAIN IN THE EMERGENCY DEPARTMENT: DIAGNOSIS AND MANAGEMENT

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### Abstract

Chest pain presents as a prevalent symptom, covering a wide range of potential diagnoses, some of which pose serious threats to life. This symptom ranks as the second most frequent complaint encountered in emergency care settings, accounting for around 5% of all visits to the emergency department. This review is a comprehensive research of PUBMED from 1996 to 2019, designed to discuss the diagnosis and management of chest pain in the emergency room.

**Keywords:** Chest Pain, Diagnosis, Management.

### Introduction:

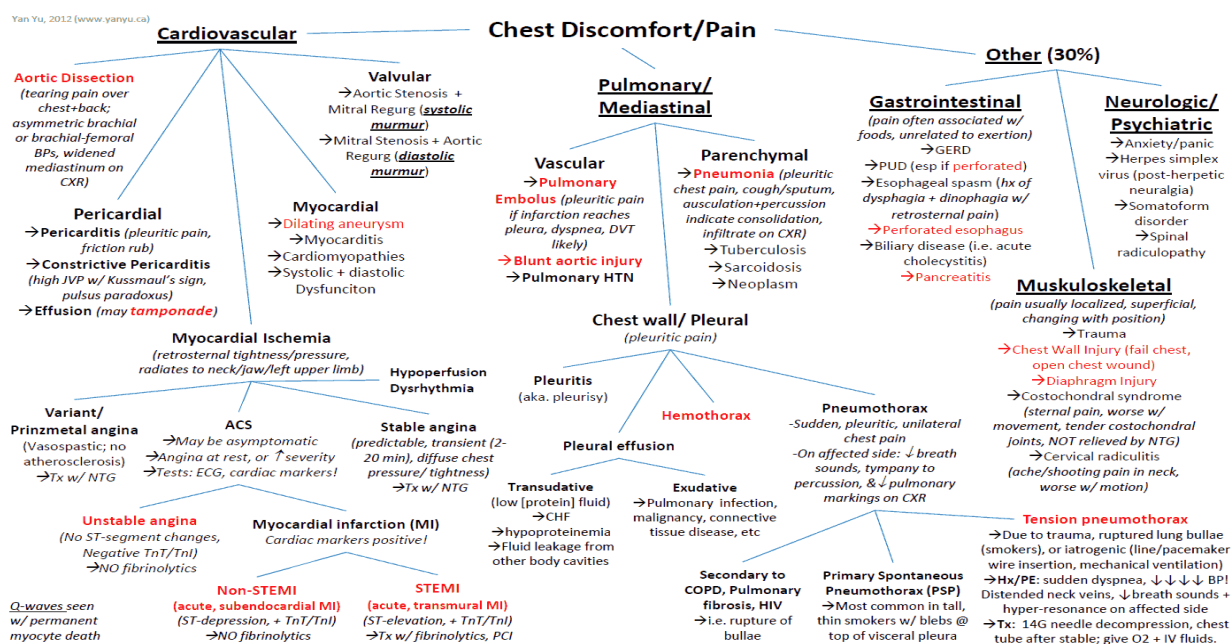
Chest pain is frequently reported and involves a wide range of possible causes, some of which could be life-threatening. It is the second most common reason for seeking medical attention in the emergency department, accounting for around 5% of all visits there. In addition, up to 25% of the general population may experience it in some manner during their lifetime.[1,2] Modern algorithms and protocols in emergency medicine and cardiology facilitate the swift handling and control of chest pain, which has been recognized for significantly enhancing the outcomes of patients with ACS.[3] When a patient presents with chest pain in the emergency department, the primary focus is identifying and addressing potential life-threatening causes. In cases of non-life-threatening chest pain, a diagnosis may only be determined following a thorough evaluation, which includes a comprehensive medical history, physical examination, and additional investigations. [4] Patient satisfaction is significant and should be given serious consideration for several reasons. Firstly, it serves as a key measure to determine adherence to treatment recommendations, follow-up visits, and more. Secondly, it provides a valuable means of evaluating medical consultations and communication styles, pinpointing areas that need enhancement. Lastly, it facilitates decision-making regarding different options in healthcare organization and delivery.[5]

### Causes of chest pain:

Acute chest pain is a clinical sign that can be triggered by various conditions affecting the thorax, abdomen, or internal organs. It can be broadly categorized as somatic or visceral. Somatic pain

pertains to musculoskeletal discomfort, major organ coverings, and dermal tissues, whereas visceral pain encompasses pain originating from organs like the heart or stomach.[6] Differentiating between chest pain caused by heart-related issues and chest pain caused by non-cardiac reasons is a crucial aspect of evaluating chest pain. It can be challenging to distinguish between the two types of pain since patients may experience both simultaneously. While non-cardiac causes are common, it is important not to overlook cardiac causes as chest pain could be a sign of cardiovascular disease (CVD).[7,8]

**Figure (1):** Differential Diagnosis of chest pain.



### None-Cardiac Cases:

Roughly 20% to 30% of chest pain patients are diagnosed with non-cardiac chest pain after undergoing standard cardiac catheterization results or other medical tests. Around 200,000 new instances of non-cardiac chest pain are reported in the United States annually. Respiratory and pleuro-pulmonary disorders are frequent culprits of non-cardiac chest pain. Additionally, pneumonia can lead to chest pain in the area affected by the infection.[9,10] Chest pain may also be linked to gastrointestinal issues such as Gastroesophageal reflux (GERD), erosive (ERD) or non-erosive (NERD), Barrett's esophagus, Esophageal motility disorders (diffuse esophageal spasm, hypercontractile esophagus, achalasia), Hypersensitive esophagus, Schatzki's ring, webs, Eosinophilic esophagitis, Mallory-Weiss syndrome, Boerhaave syndrome, Drug-induced esophageal ulcer, Infection (viral, thrush, esophagitis), Gastroduodenal ulcer, Pancreatitis, biliary colic, cholangitis.

GERD-related chest pain can be controlled with a proton pump inhibitor in most cases. Furthermore, weight loss is recommended for patients with GERD and non-cardiac chest pain, regardless of whether they are overweight or obese. While certain lifestyle adjustments like avoiding trigger foods and elevating the head of the bed may not fully relieve GERD-related chest pain.[11]

Costochondritis, inflammation of a rib or cartilage linked to a lung, is a frequent cause of non-cardiac chest pain. Pain relievers, local anesthetics, or anti-inflammatory medications can alleviate this condition. Infectious illnesses such as herpes zoster can also lead to widespread chest pain.[12] Injuries to the ribs, like bruises, breaks, and fractures, can result in chest pain. If someone has a broken rib, they might hear a crack or experience severe pain at the moment of injury.

**Cardiac Causes:**

ACS, pulmonary embolism (PE), and aortic dissection are other conditions that fall under this category. ACS stands out as the most severe type of chest pain, with the potential to be deadly. ACS is a specific classification covering any condition leading to myocardial ischemia, ranging from unstable angina to acute myocardial infarction (AMI). It is identified in 15% to 25% of individuals experiencing chest pain.[13,14] Angina, the typical presentation of myocardial ischemia, is commonly characterized as severe chest discomfort or a sensation of tightness or burning, often accompanied by breathing problems. Angina usually spreads to the left shoulder, back, or arm and intensifies over a few minutes.[15] One of the most serious and deadly aortic emergencies is acute aortic dissection, which has the highest mortality rate among causes of chest pains that are life-threatening. Acute aortic dissection is characterized by a sudden onset of intense, tearing pain that indicates the location of the dissection and how it progresses. Aortic dissection can also lead to stroke, heart failure, fainting, pain in the lower extremities or fatigue, as well as back and flank pain and abdominal discomfort.[7,14,15]

**Diagnosis:**

Identifying patients with acute coronary syndromes (unstable angina, acute myocardial infarction, or evolving infarction) is crucial. Nevertheless, there are several challenges in detecting these patients.[16] Chest pain can sometimes be mistaken for abdominal pain, especially when the upper abdominal areas are epigastric or higher. The clinician must consider that the presentations within these categories can be classified as "traditional," "atypical," or somewhere between. To determine the cause of the pain, patients with chest pain syndrome should be promptly diagnosed. The primary urgent measures to be taken include an ECG, a thorough history, and a physical examination. Unless the patient urgently needs to go to the cardiac catheterization lab based on these factors, a chest X-ray should also be done quickly.[17]

History (table1), physical examination (table 2), and It is imperative to conduct these tests promptly to ensure timely and appropriate medical intervention, thereby improving the patient's prognosis and overall outcome. By utilizing advanced diagnostic tools such as ECG, Blood tests, Chest X-ray, and CT scans, healthcare professionals can efficiently diagnose and manage cardiovascular and pulmonary issues, leading to better patient care and outcomes (Figure2).[18,19]

Onset:	Inquire about when the pain began and the patient's activity at the onset of the pain. Did the pain arise due to physical exertion or while at rest?
Location:	Can the patient pinpoint the pain using one finger, or is it spread out?
Duration:	For what duration did the pain persist?
Character:	Allow the patient to explain the pain using their own words.
Aggravating factors:	It is crucial to determine the factors that exacerbate the pain. Is there a connection to physical activity, eating, or breathing? Does it worsen in certain positions? Also, inquire about recent changes in exercise routines, sports activities, and lifting. Inquire about the medications that have been tested.
Radiation:	This could give you an indication of intense pain.
Timing:	How often do they go through this pain? How long does the pain subside for?
Past history:	Inquire about the patient's medical background concerning cardiac issues, coagulopathies, and kidney disease.
Family history:	Gather information on family history, particularly regarding cardiac disease.
Social history:	Inquiry about drug and tobacco usage.
Table (1): the key of history for chest pain.	

Complete set of vital signs, which includes taking blood pressure readings in both arms.
Observing the general appearance, paying attention to diaphoresis and distress.
Examine the skin for any signs of lesions, such as shingles.
Assessment of the neck for jugular venous distension (JVD), particularly when checking for Kussmaul sign during inspiration.
Examine the chest for consistent pain and crepitus.
Cardiac examination.
Respiratory examination.
Abdominal examination.
Symmetrical, equal pulses are observed for calf pain, edema, and unilateral swelling in the extremities.
Table (2): Composition of chest pain physical examination.[20]

Diagnosis of myocardial infarction is typically established based on the observation of an ischemic ECG, a suggestive clinical history, or the detection of circulating biomarkers of myocardial necrosis such as Troponin. In order to confirm a diagnosis of myocardial infarction, at least two out of these three criteria need to be met. It is important to note that a significant percentage, ranging from 40% to 60%, of individuals who are later diagnosed with acute coronary syndrome initially present with an ECG that does not initially show clear signs of ischemia upon arrival at the emergency department.[21] However, a proportion of these patients may not exhibit elevated levels of troponin, while individuals experiencing unstable angina will not show elevated troponin at any point unless they progress to developing a myocardial infarction. This indicates that the primary method of identifying these individuals initially is by delving into the history of their presenting complaint. The comprehensive scope of coronary artery disease often remains unclear until the patient is subjected to invasive procedures like coronary angiography.[22,23] The ECG is a valuable instrument in diagnosing Right Inferior Myocardial Infarction (RIMI) due to its high specificity, which ranges from 77% to 100% depending on the specific parameters utilized. Nevertheless, within the initial 12 hours, the sensitivity of ECG is relatively low, falling between 28 percent and 54 percent, indicating that an individual with a normal ECG result might still be experiencing AMI. Consequently, relying solely on an ECG outcome does not offer adequate assurance to discharge a patient from the Emergency Department (ED). Therefore, during this phase, the ECG should be utilized to pinpoint patients who should be considered for administering fibrinolytic drugs.[24,25]

Troponins are proteins that create the regulatory complex for tropomyosin (TRC), which controls the actin-myosin complex in muscle. TroponinT and I in the heart muscle are unique as they are predominantly produced by cardiac myocytes.[26]

Figure (3): Diagnostic tools for chest pain.

**Electrocardiogram (ECG):**

- A procedure that monitors the heart's electrical activity through the placement of electrodes on the skin. This method is used to identify abnormalities in the heart's electrical impulses, particularly in cases of heart attacks, whether past or ongoing.
- Is the initial stages in the differential diagnostic process and generally enable the detection of features indicating a high risk of life-threatening illness. ST segment elevation on the ECG may indicate the need for cardiac catheterization.

**Blood tests:**

- To examine the levels of specific proteins or enzymes (troponin) that are typically found in the heart muscle. These proteins or enzymes may leak into the bloodstream over time due to heart cell damage caused by a heart attack.

**Chest x-ray:**

- Enables healthcare professionals to assess the condition of the lungs, the size and shape of the heart, and the major blood vessels. Furthermore, a chest x-ray can reveal issues such as pneumonia or a collapsed lung.

**Computerized tomography (CT scan):**

- Utilized to identify a pulmonary embolism (blood clot in the lung) or rule out the presence of aortic dissection. CT scans provide detailed images that help in diagnosing various heart and lung conditions.

**Management:**

Efforts to enhance the effectiveness of evaluating chest pain patients in the ED have involved integrating newer diagnostic strategies and methods, including new cardiac biomarkers and noninvasive imaging. The benefit of applying a systematic approach to managing chest pain patients can be evaluated through various means.[27] Patients who have chest pain and meet the criteria for acute coronary syndrome should have a heart monitor placed on them. Additionally, they should receive intravascular access, chewable aspirin between 162 mg to 325 mg, and either clopidogrel or ticagrelor (unless they are about to undergo bypass surgery). It is also important to consider providing pain control and oxygen therapy. Nitroglycerin has been shown to have a positive impact on mortality. The goal is to reduce mean arterial pressure by 10% in normotensive patients and by 30% in hypertensive patients. However, nitroglycerin should be avoided in hypotensive patients and in those with inferior ST elevation. Patients with ST elevation on their electrocardiogram should promptly receive reperfusion therapy, either through pharmacologic means (thrombolytics) or by being transferred to the catheterization lab for percutaneous coronary intervention (PCI).[28] In patients experiencing chest pain but not meeting ACS criteria, sublingual nitroglycerin can be administered for symptom relief. It is important to note that the resolution of symptoms does not automatically indicate a diagnosis of myocardial ischemia, and lack of relief does not suggest an alternative diagnosis. Other treatment options include oxygen via nasal cannula (2 to 4L), aspirin 325 mg orally, and pain management with morphine (2 to 5 mg intravenously every 5 to 15 minutes).

**Figure (2):** Drugs used in the treatment of some of the most common causes of chest pain. [29-33]**Artery relaxers:**

- Nitroglycerin is commonly administered in tablet form under the tongue to relax the arteries of the heart, which in turn facilitates the smoother flow of blood through narrow spaces. Additionally, many medications for blood pressure work by relaxing and dilating

**Asprin:**

- If physicians have a suspicion that the chest pain you are experiencing is connected to your heart, it is probable that they will administer aspirin to you for treatment.

**Thrombolytic drugs:**

- Patients who have experienced a heart attack may be administered clot-busting medications to dissolve the blockage preventing blood flow to the heart muscle.

**Blood thinners:**

- When a blood clot occurs in an artery supplying the heart or lungs, medications are used to prevent further clot formation by inhibiting blood clotting.

**Acid-suppressing medications:**

- When chest pain occurs due to stomach acid splashing into the esophagus, the doctor might recommend medications that decrease the acid levels in your stomach.

**Antidepressants:**

- Physicians might recommend antidepressants to manage symptoms in patients experiencing panic attacks. Additionally, psychological treatments like cognitive-behavioral therapy could be suggested.

**Muscle relaxant**

- When chest pain is caused by muscle strain, the doctor may prescribe medicines to help in muscle relax.

**Conclusion:**

Chest pain is a common symptom seen in medical practice. A comprehensive medical history is usually helpful in making a diagnosis. It is crucial not to overlook serious conditions like a heart attack or aortic dissection. If the cause of chest pain is uncertain, it is advisable to refer the patient to a specialist for further evaluation. The prognosis of patients with chest pain varies depending on the underlying cause.

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