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Introductory Chapter: The Patient Presenting with Chest Pain

John-Ross D. Clarke

1. Background

Chest pain is the principal reason for approximately 5% of the emergency department (ED) visits in the United States [1]. It is the most frequent reason for presentation to an emergency facility in men age 65 years and older. In some cohorts, chest pain accounts for up to 16% of ambulance transports and constitutes almost 30% of emergency admissions [2, 3]. In the primary care setting however, less than 1% of visits are for a chief complaint of chest pain [4].

Part of the significance of chest pain as a presenting symptom is its association with potentially life-threatening diagnoses such as: acute myocardial infarction (AMI), pulmonary embolism, and aortic dissection, among others. The challenge for the clinician is the accurate stratification of patients based on risk, and the efficient and cost-effective utilization of resources to establish a diagnosis. The first step in diagnosis is an informed history and physical examination- which is not without limitations even in the most experienced hands [5]. The sections that follow provide a brief insight into the scope of chest pain diagnoses and the value of clinical findings in establishing a diagnosis.

2. The differential diagnosis of chest pain

The differential diagnosis of a patient presenting with chest pain is extensive [6]. A systematic approach is therefore needed to (i) determine the likelihood of an immediately life-threatening cause, (ii) differentiate cardiac from noncardiac etiologies, and (iii) reduce over-diagnosis and thus overutilization of healthcare resources in the subsequent investigation. This approach not only increases the diagnostic accuracy and efficiency of workup, but also leads to better patient and clinician satisfaction [7].

There are innumerable ways of categorizing the differential diagnosis of chest pain. Potential categorization approaches are: (i) cardiac vs. noncardiac etiologies (ii) classifying based on symptom characteristics, (iii) by organ systems and (iv) anatomically (**Figure 1**). An anatomic approach allows for an exhaustive differential diagnosis but does have limitations in refinement based on pre-test probability- this subsequent step requires the incorporation of other aspects of symptom presentation [6].

A schema for classifying causes of chest pain anatomically includes structures from the skin to internal organs of the thorax and upper abdomen (**Figure 1**).
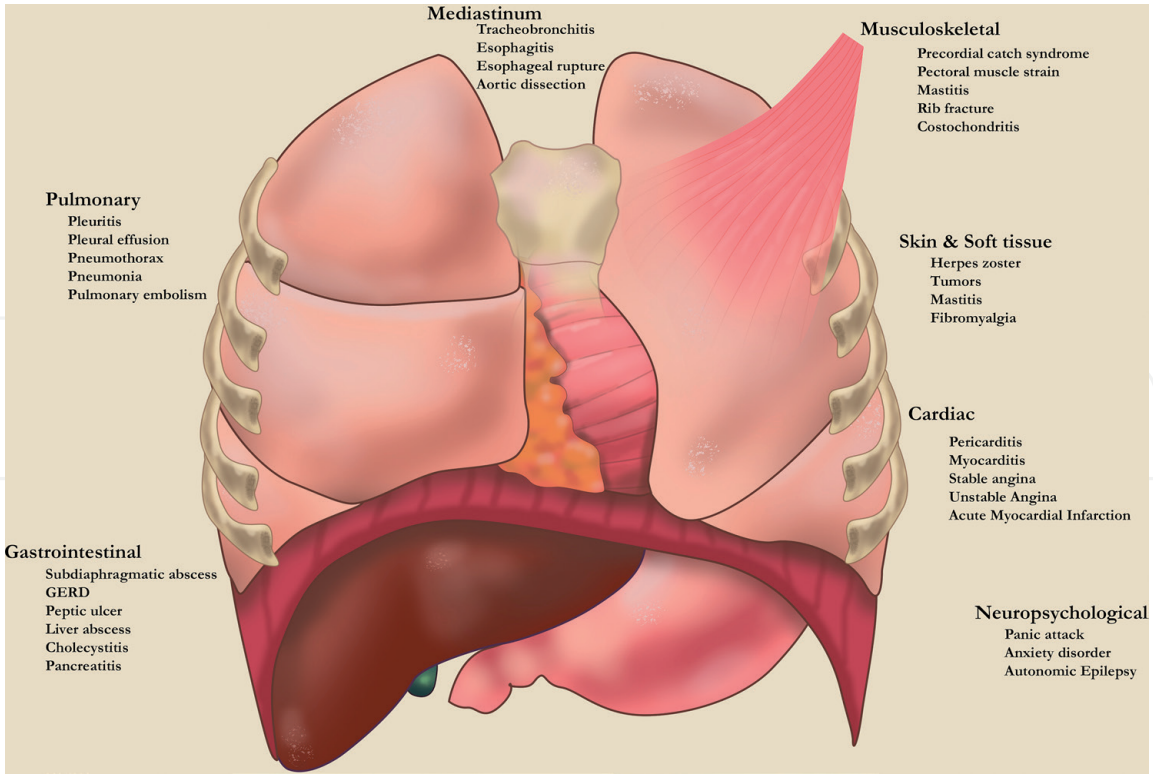
Figure 1.
An anatomic approach to the differential diagnosis of chest pain.

3. The clinical value of the chest pain presentation

The clinical assessment of a patient presenting with chest pain has undergone extensive research, particularly in its ability to detect ischemic cardiac and other life-threatening causes, e.g., acute pulmonary embolism [5]. Due to the potential limitations of history and physical examination in certain settings, the inclusion of early diagnostic tools such as the electrocardiogram, or serum d-dimer, have been validated in many risk prediction models to aid the clinician in decision making [8].

In addition to the details of the chest pain history, the acuity and setting of patient presentation also provide valuable clues to the differential. The traditional life-threatening conditions taught in medical training have been found to make up about 5% of the chest pain diagnoses in ED visits [9]. Over 90% of these life-threatening diagnoses are due to acute coronary syndrome (ACS). In the primary care setting on the contrary, less than 2% of patients will end up having ACS [10]. Up to one-third of the causes for chest pain in ambulatory visits are due to chest wall-related pain [11, 12].

All the important considerations of chest pain details will not be covered here. Key qualifiers though are the location, quality, acuity, evolution, and the frequency of the pain; as well as a history of prior ischemic cardiac events (of similar or differing character). Additional information is needed on associated symptoms as well as aggravating and relieving factors [13]. This large volume of data can be synthesized into illness scripts to describe the most likely syndrome(s) accounting for the chest pain. This summative processing allows for further diagnostic refinement, especially when discordant information is present [14].

It is worth reiterating that the art of history taking is susceptible to misinterpretation on the part of both the interviewer and the patient. Cognitive biases from the clinician and cultural differences in the understanding of certain descriptors means that interpretations should be restated and clarified throughout the history taking process [15].

3.1 Diagnostic accuracy of symptoms and signs in acute coronary syndromes

No single clinical symptom or sign can rule in or out the possibility of ACS or acute MI. However, a constellation of patient characteristics, clinical symptoms and signs can be used to determine the pretest likelihood with some diagnostic accuracy [16]. The traditional highest risk group has been patients of male gender, older than 60 years, presenting with "pressure-type" chest pain radiating to the neck, shoulder or arm [17].

The traditional predictor of "pressure-like" symptoms has been noted to have only a likelihood ratio of between 1 and 2 in predicting AMI in patients presenting with chest pain. The use of "sharp" or "stabbing" to characterize symptoms more significantly decreases the likelihood of MI (LR− = 0.3) [18]. Descriptors associated with the diagnosis of AMI in decreasing order of likelihood are: (i) pain radiating to the right and left arm simultaneously (LR+ = 7.1), (ii) association with exertion (LR+ = 2.4), (iii) radiation to the left arm only (LR+ = 2.3) and (iv) association with diaphoresis (LR+ = 2.0). Conversely, symptoms associated with increasing likelihood of the pain not being related to AMI are: (i) absence of an relation to exertion (LR− = 0.8) and (ii) descriptors such as "pleuritic" or "positional variation" (LR− = 0.2 & 0.3 respectively) [5].

3.2 Diagnostic accuracy of symptoms and signs in noncardiac causes of chest pain

Once a cardiac etiology of chest pain is deemed to be unlikely, the diagnostic puzzle is in determining which of the many other differentials is most likely. Fortunately, similar to their cardiac counterparts, noncardiac etiologies have certain key features on both history of physical exam which can be used to streamline the diagnostic approach.

It was mentioned earlier that chest wall-related pain is the most common etiology in some ambulatory settings. Four clinical symptoms/signs which are highly suggestive of a chest wall-related etiology are: localized muscle tension, "stinging" nature of the pain, reproducibility on palpation and an absence of cough [16]. The presence of at least two of these findings has a LR+ of 3.0.

No evidence-based clinical maneuvers exist to aid in the diagnosis of gastro-esophageal reflux disease (GERD) [10]. Common associated complaints are "burning" retrosternal discomfort, regurgitation of gastric contents and a bitter taste in the mouth [19]. One approach which is supported by evidence, is the response of symptoms to a one-week trial of proton pump inhibitors (LR+ = 3.1; LR− = 0.3) [20].

Other less common causes of chest pain such as pneumonia, pulmonary embolism and acute thoracic dissection can be suspected based on history but cannot be ruled in or out without the support of definitive testing. Features such as fever, cough and pleurisy (with suggestive examination findings), have a performance of LR+ = 2.0; LR− = 0.24 for the diagnosis of pneumonia [21]. Validated clinical decision tools, such as Well's criteria, guide further testing when a pulmonary embolism is suspected [22]. Finally, although acute chest pain and/or back pain with an upper extremity pulse differential can help with risk stratification for the likelihood of an acute thoracic aortic dissection (LR+ = 5.3), definitive imaging is required [23].

4. Outcomes and implications of patients presenting with chest pain

Half of the chest pain presentations to the ED are left unspecified [9]. The majority of these end up being noncardiac etiologies when they are followed up

in the primary care setting. In patients presenting to the ambulatory setting for the first time with chest pain, etiologies such as angina, AMI, musculoskeletal pain or GERD can be diagnosed at the first consultation. However, the incidence of chest pain going unspecified remains about 15 per 1000 person-years [24]. Approximately 2–10% of these individuals will go on to have cardiovascular disease as the cause of their symptoms [25]. A definitive diagnosis is most often made by 12 weeks of follow-up- if not within the first year. During this time period though, patients are likely to have: (i) seen their physician on up to three separate occasions, (ii) been referred to a specialist or (iii) hospitalized [24]. This time course leads to both clinician and patient anxiety, and can negatively impact quality of life [26].

One of the feared outcomes in patients presenting to an ED with chest pain, is the inadvertent discharge of someone with ACS. Older estimates suggested rates of this could be as high as 2% [27]. Thankfully, with the advent of newer diagnostic modalities, risk scores and investigative protocols, the risk of this outcome is likely to continue to decline [28]. An effort to mitigate this risk must be balanced against the costly and potentially harmful consequences of unnecessary hospitalization or extensive workup [28]. The fear of missing a potentially life-threatening diagnosis like ACS is no less apparent with ambulatory contact [29].

5. Conclusions

Chest pain is a common reason for hospital admission. Most patients who present to either an emergency department or primary care clinic will end up having a noncardiac cause of their symptoms. However, due to the poor outcomes associated with cardiovascular etiologies, significant healthcare resources are used in ruling in or out ischemic cardiac causes; when an alternative is not obvious. For these reasons, it is prudent that we continue to develop systems to efficiently differentiate between the many causes of chest pain.

Conflict of interest

The author has no conflicts of interest to declare.

Author details

John-Ross D. Clarke
Department of Internal Medicine, Yale-New Haven Health Bridgeport Hospital, Bridgeport, CT, USA

*Address all correspondence to: johnrossclarke@gmail.com

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